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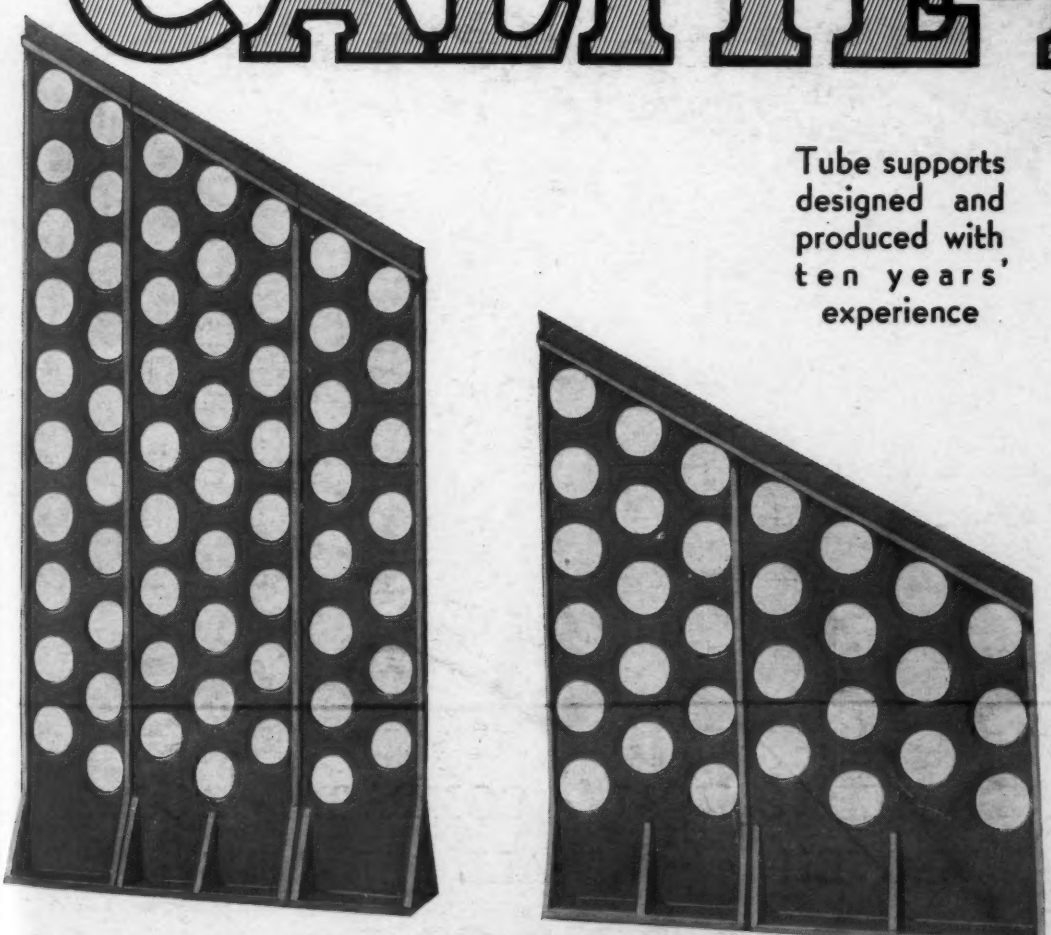

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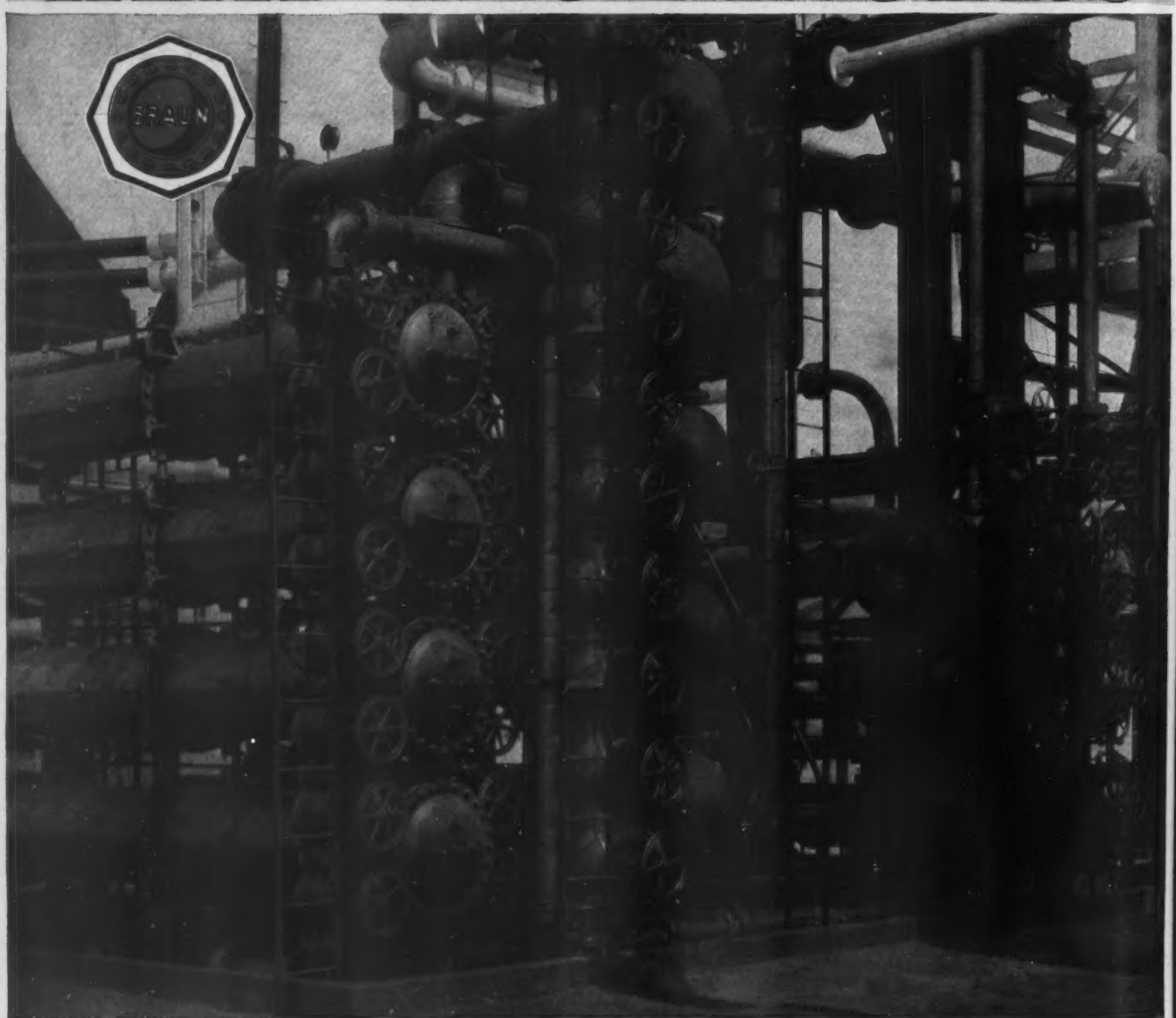

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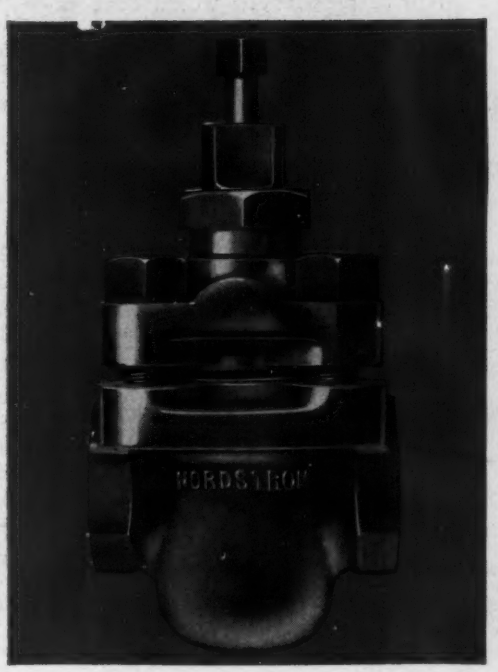

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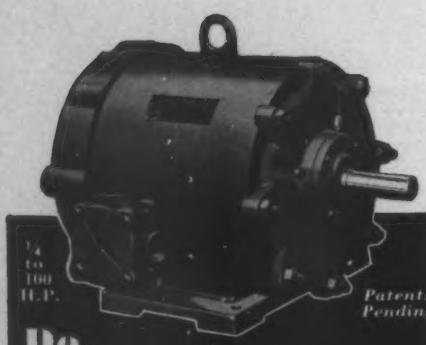

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THE MONTH IN REVIEW

In the following columns will be found a brief digest of happenings of interest to refiners, with even reference to a rumor or two!

CRUDE oil production is now down 550,000 barrels a day from the peak established during August, 1929. Practically all flush producing states have succeeded in reducing their crude output to or below the maximum allowable proration quotas. Ordinarily, a decline in crude production of such extensive proportions would have exerted a favorable influence upon the general market structure of the industry. However, the state of the oil market is no longer dictated by the trend of crude production, but by the status of the gasoline situation. Efforts to reduce refinery runs have met with some degree of success, but present stocks of gasoline show that there has been, and is now, an urgent need for further stringent curtailment of still runs. Unless refinery still runs are substantially curtailed at least another 50,000 to 75,000 barrels daily, the industry faces the prospect of further demoralization in the general market structure.

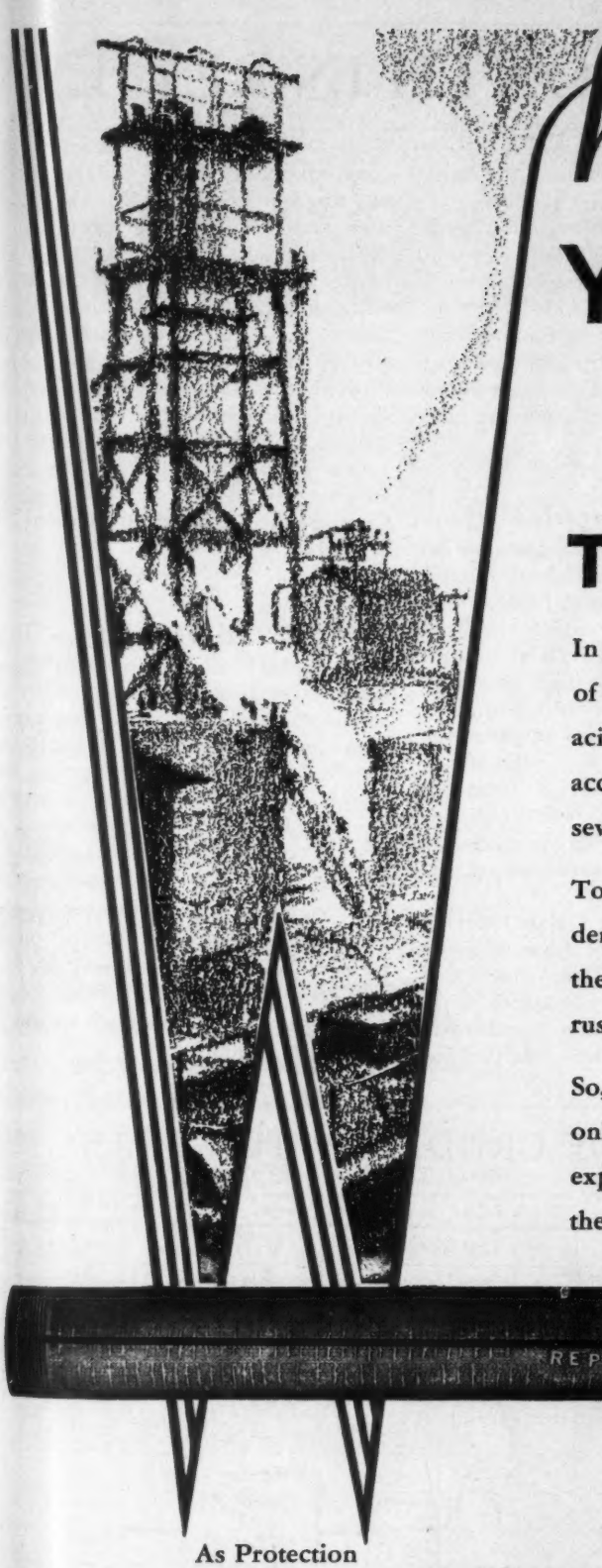
WORLD production of petro- leum during the current year will probably be close to 1,444,000,000 barrels, according to a preliminary survey made by Valentine R. Garfias, manager of the Foreign Oil Department of Henry L. Doherty & Company, New York. Mr. Garfias has concluded that the total world production this year will probably show a decline of about 44,000,000 barrels as compared with an increase last year of 161,000,000 barrels. His estimates also show that crude production of the United States will probably show a decrease of about 69,000,000 barrels this year, although he believes that storage figures will reveal an increase over the quantity on hand at the end of last year.

GASOLINE imports for the first seven months of this year aggregated 9,898,650 barrels, a gain over the same period of last year of 5,449,655 barrels. Of the total imported gasoline for the first seven months of this year, 9,077,357 barrels was directly imported from the Dutch West Indies. In connection with the increased importation of gasoline into the United States, it is interesting to learn that Benzol exports to the Dutch West Indies have lately shown an unusual gain, the quantity exported to Curacao during June and July, 1930, amounting to 2,289,225 gallons and 2,457,014 gallons, respectively. Last year there were no exports of benzol to the Dutch West Indies. The reason for this sharp increased demand for benzol is attributed to the recent completion at Curacao of a large blending plant where motor fuel can be blended and shipped directly to the United States and sold in competition with American blended gasoline.

PIPE line and tank farm stocks of crude petroleum showed a decline of 1,381,000 barrels, east of the Rocky Mountains, during August, according to returns compiled by the American Petroleum Institute. It is expected that the monthly Bureau of Mines report for August will show a material decline in total crude stocks of the United States, reflecting to a marked degree the efforts of producers to bring crude production down to a normal level.

GASOLINE consumption of 44 states during July aggregated 1,145,063,000 gallons. For the first seven months of this year, reports received from 42 states, excluding New York and Illinois, showed a total consumption of 5,629,582,000 gallons, or an increase over the same period of last year of 26,555,000 gallons. This represents a gain over last year of nine per cent.

LEGAL action has been taken by Danciger Oil & Refining Company of Texas against the Texas Railroad Commission as regards the enforcement of the latter's state-wide proration order of August 14, by obtaining a temporary injunction that will permit the plaintiff to produce its wells without restrictions. This is the first formal attack on proration; a number of operators have been silently ignoring the order when not dependent upon major pipe line companies. Danciger Oil & Refining Company was granted the temporary injunction at Austin on September 25, after submitting a



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THE MONTH IN REVIEW

lengthy petition that outlined the basis for its plea for relief.

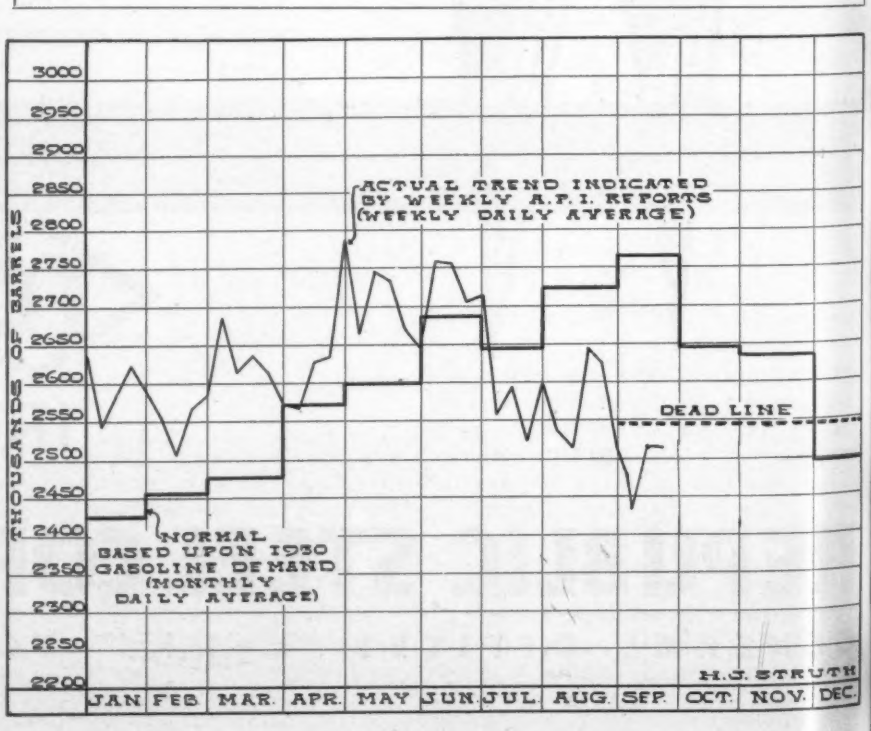
Failure of proration allowances earned by Danciger Oil & Refining Company from its properties to furnish adequate crude for the 5000-barrel refinery at Pampa of Petroleum Refractionating Corporation, an affiliated concern, was the principal reason offered in the petition for relief from the proration order.

OKLAHOMA proration affairs moved with rapid strides September 30. At Oklahoma City the federal district court, with three judges sitting, ruled that the statute under which the Corporation Commission of Oklahoma issues and enforces proration orders is constitutional. The present proration schedule for the state was extended for 10 days into October by order of the corporation commission. In Tulsa the proration committee of Mid-Continent Oil & Gas Association prepared a schedule for the last three months of the year.

The court ruling at Oklahoma City was on the petition of Champlin Refining Company of Enid, which had asked for interlocutory injunction, restraining the corporation commission from enforcing proration orders. The constitutionality of the Oklahoma statute was questioned, while the charge was made that through proration orders, the leading oil companies are but fixing prices. The Supreme Court of Oklahoma has yet to rule on the petition of C. C. Julian, who sought to restrain the corporation commission through the state court. In legal circles it is thought that any further move against the constitutionality of the proration statute will be by taking the Julian case direct to the Supreme Court of the United States, in case it is favorable to the State.

ORGANIZATION of an Oklahoma branch of Independent Petroleum Association of America was made the occasion of a verbal barrage against imports of crude oil and products and especially against the Shell group. The meeting was held at Tulsa on September 29. Efforts are to be made to secure a tariff at the coming short session of congress. Speakers voiced the opinion that American interests that have exported capital to import oil can be persuaded to reason, but that Shell can never be expected to shape its policies with any consideration for the independent producer.

RUNS OF CRUDE OIL TO STILLS



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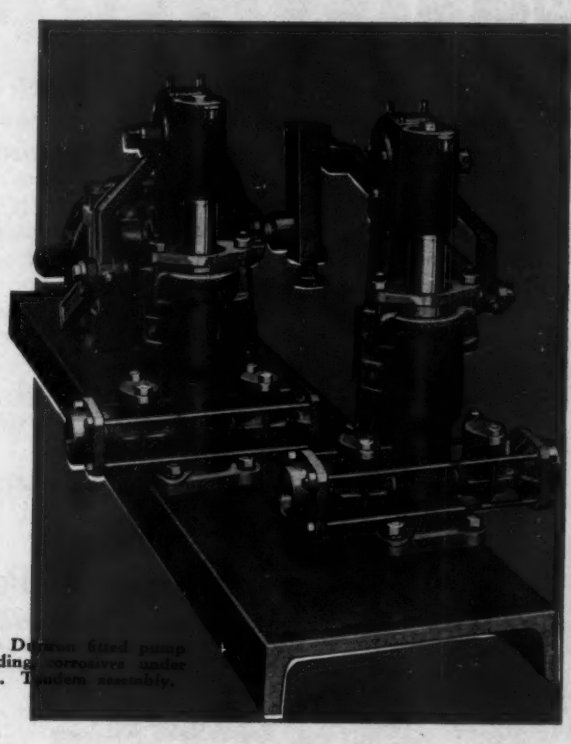

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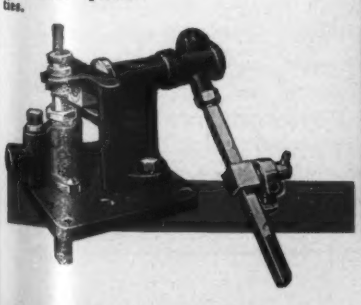
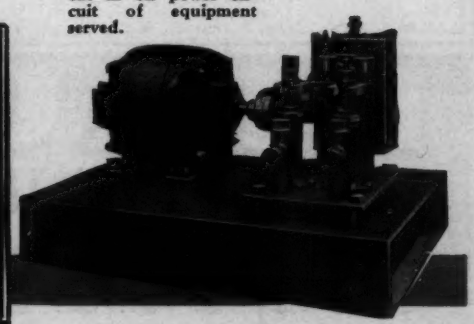


Two feed motor driven unit which may be cut in on power circuit of equipment served.



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The Month in Review

NEW wells started during September show a greater ratio of decrease than for the first nine months. In September, 1930, the new wells numbered 826 against 1228 a year ago. Up to the end of September last year the total was 11,845; this year 10,519.

WADHAMS Oil Corporation has been merged with Vacuum Oil Company on a basis of an exchange of stock, 90 shares of the former will be exchanged for 90 shares of Vacuum Oil Company stock. Last year Wadhams Oil Company absorbed Bartles-Maguire Oil Company, both of Milwaukee, to form Wadhams Oil Corporation. The combined resources of these two companies was said to approximate $7,000,000, with a 4000-barrel refinery at East Chicago, Illinois, and 250 owned bulk and retail stations. The sales volume of the company approximated 50,000,000 gallons yearly. Merger of Wadhams Oil Corporation with Vacuum Oil Company will effect economies of operation without duplication of effort, according to an announcement by Vacuum Oil Company officials.

PETROLEUM from Well to Market" and "Gasoline, 30 Questions Answered," are the latest booklets in the "Oil Industry Series" to be published by the American Petroleum Institute.

The former, No. 10 of the series, has been commended by readers as a highly important and interesting story that every oil employe, stockholder and customer should read. The latter, No. 9, is a compilation of answers to questions about gasoline frequently asked by the motorist. It covers volatility, energy, detonation, anti-knock fuels, mileage, waste, production, transportation, taxes, variation in prices and safeguards.

CHARLES McLean, vice-president Canfield Oil Company, Cleveland, has recently called attention to the fact that, according to the Bureau of Industrial Service, there is enough crude recoverable from Pennsylvania fields by modern methods to lubricate all the automobiles in the United States for a period of 50 years at least; and even at that time, the report asserts that half the original supply of Pennsylvania crude in the ground could be brought to the surface by new methods which may be devised in the meantime.

Mr. McLean calls attention to the fact,

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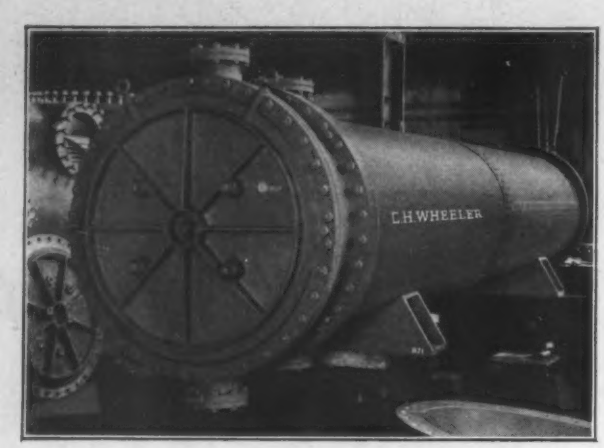

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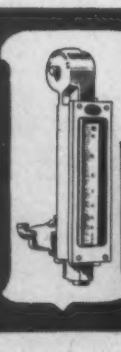

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The Month in Review

that, substantiating this statement, the output of Pennsylvania grade crude in April, 1930, amounted to 80,000 barrels a day, which practically equals the greatest output in the history of the field.

"On the whole," he continues, "the situation is more favorable for the producers, refiners and marketers of Pennsylvania motor oils than it has been at any time during the past 40 years and more of our experience."

WHEN, on September 22, at Jersey City, New Jersey, Edward G. Seubert handed E. W. Sinclair a check for $72,500,000, a new record for commercial transactions was established, and sale of Sinclair Consolidated Oil Corporation's half of Sinclair Crude Oil Purchasing Company and Sinclair Pipe Line Company to Standard Oil Company (Indiana) was finally consummated. The two men handling the transaction are presidents of their respective companies. The pipe line system extends from Houston to Chicago with a branch to Wyoming and gathering lines in Oklahoma and Texas. Included in the assets of the purchasing company and transfeerred in the sale, was 36,000,000 barrels of stored oil. Names of the purchased companies are to be changed to Stanolind in place of Sinclair.

LOUISIANA Oil Refining Corpo- ration has been acquired by Cities Service Oil Company, title passing to Arkansas Natural Gas Company, a subsidiary of the Doherty organization. Announcement says there will be no change in organization and operation at present. Properties involved include 23,000 barrels of refining capacity at Shreveport, and 155 bulk plants and around 1000 filling stations. The marketing properties are in Louisiana, Mississippi, Arkansas, Tennessee and Eastern Texas, where the company has been very aggressive in sales and pioneered sale of tires through company owned filling stations. Consideration involved was around $25,000,000. Cities Service is dominant in the gas business in those sections of Louisiana and Arkansas where bulk of the acquired marketing properties are located.

LION Oil Refining Company, El Dorado, Arkansas, was mentioned in connection with rumors of Cities Service Company's acquisition of Louisiana Oil Refining Corporation previous to consummation. T. H. Barton, president of Lion Oil Refining Corporation, denied that the deal was even considered.

A Gulf Publishing Company Publication

THE REFINER

and Natural Gasoline Manufacturer

Member Audit Bureau of Circulations

VOL. 9, No. 10

OCTOBER, 1930

GRADY TRIPLETT, *Editor*

GEORGE REID, *Associate Editor*

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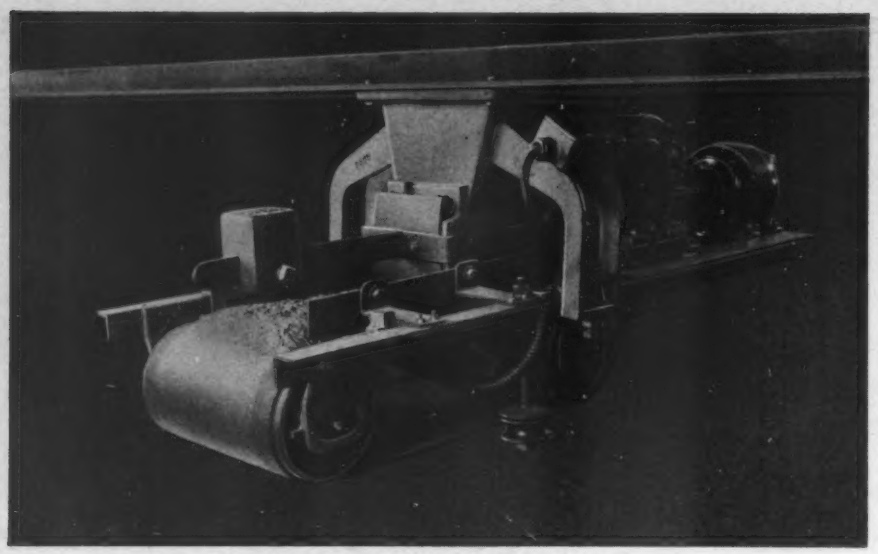

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A Gulf Publishing Company Publication

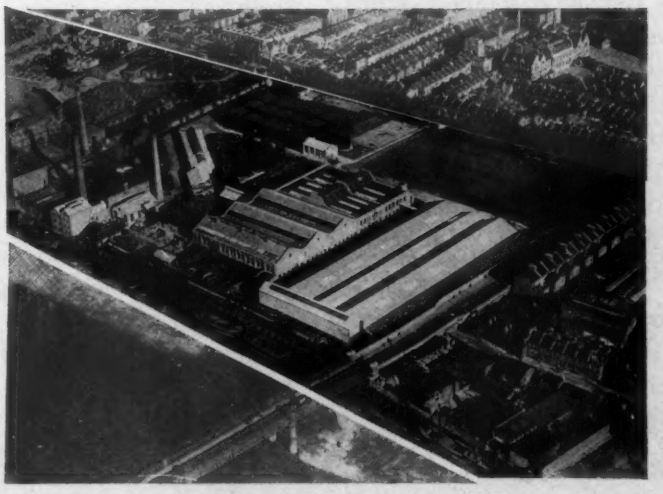
VOLUME 9, No. 10 OCTOBER, 1930

REFINING in Europe during the next few years is to assume much greater proportions insofar as crude oil processing capacity is concerned. The expansion of this industry in Europe will involve the expenditure of millions of dollars in the installation of modern, scientific oil processing equipment.

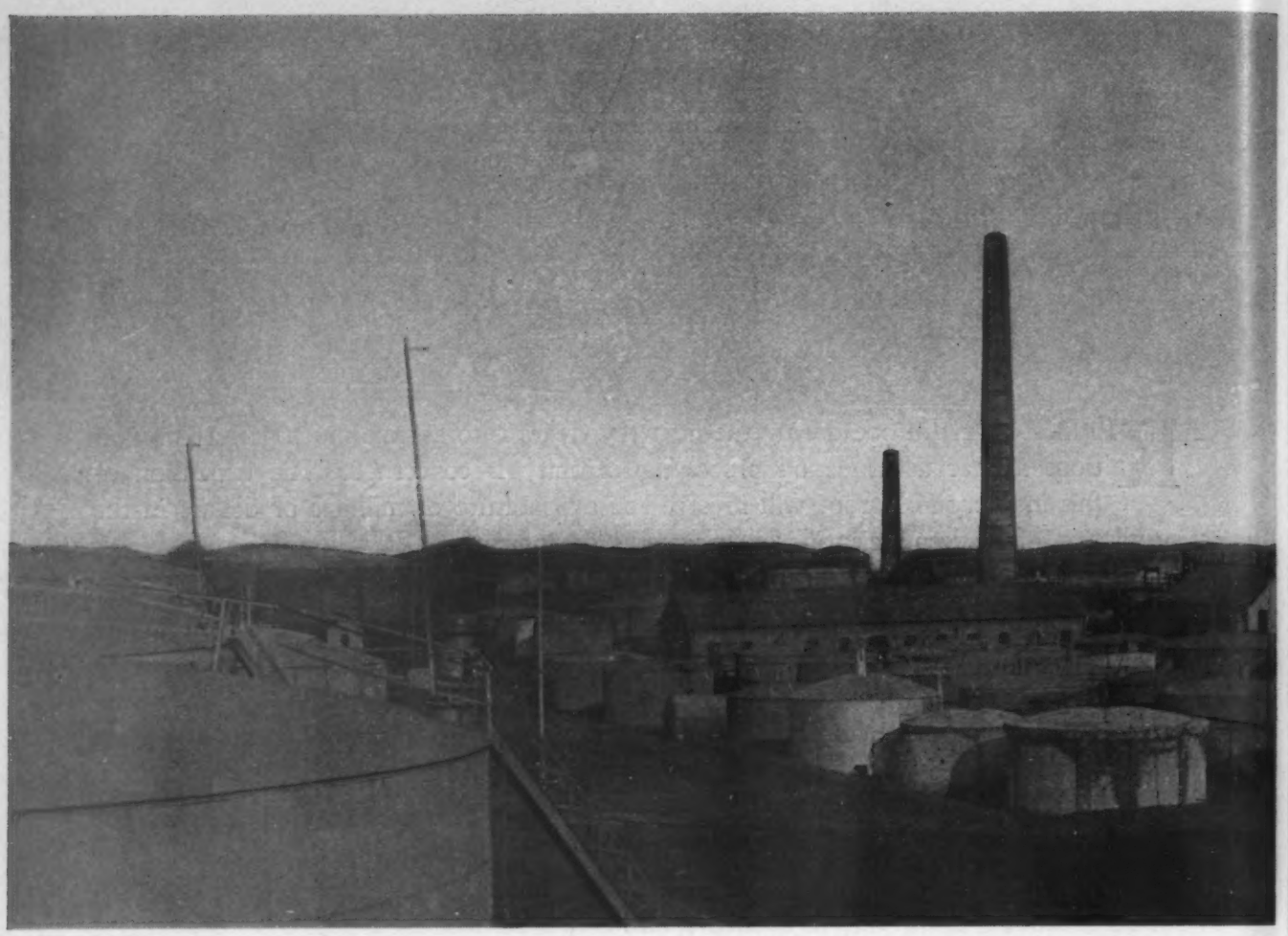
A dozen or more new refineries are planned or proposed in the leading European countries, many companies are contemplating newly designed lubricating oil manufacturing facilities, and installation of cracking processes is under way or planned by refining organizations in practically every European nation. Equipment for the manufacture of liquefied petroleum gases, and units for the debutanization of cracking plant products are numbered among the proposed additions to present refining installations.

Because of the ever increasing importance of the European refining industry the following symposium of the present status of refining in all European countries is presented. In addition to the discussion of present conditions the survey looks into the future of refining in the various countries, and is indicative of the trends toward increased production of finished petroleum products.

We are particularly pleased that the presentation of this detailed discussion of European refining conditions, so comprehensive in scope, is possible at the time of the annual gathering together of the personnel of the refining industry from all parts of the world during the International Petroleum Exposition and Congress.



Wandsworth Works of Vacuum Oil Company, Ltd., London, England



European Refining

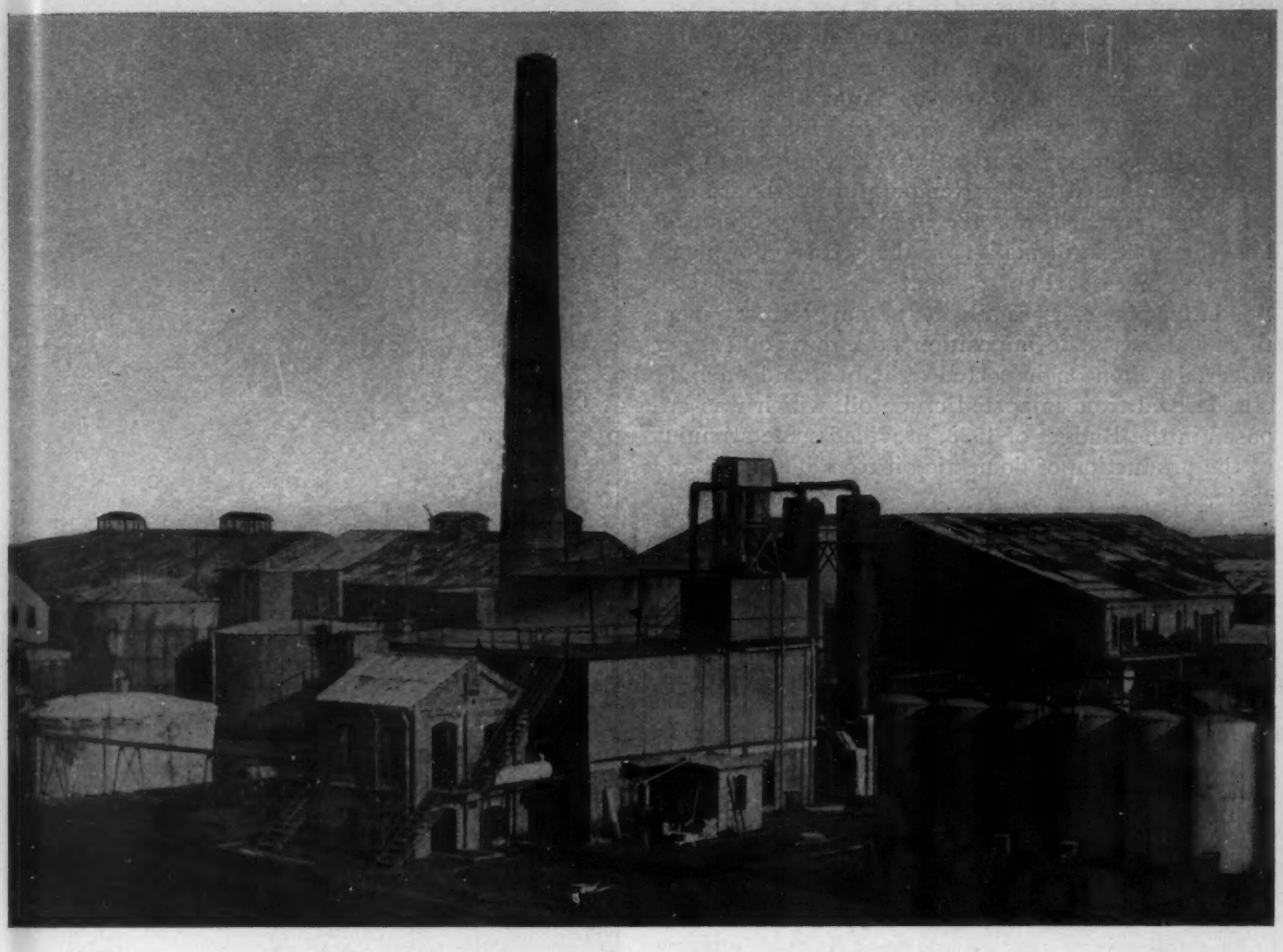
THE relative importance of the European refining industry in general to the American petroleum industry is better known when it is understood that for many years Europe has taken slightly in excess of 50 per cent of all of our American refined oil exports, with a total value of $500,000,000, and that aside from England, our best customer for oil and the next largest world consuming nation after the United States, and which refines some 30,000,000 barrels of oil a year, no real refining industry as it is understood in the United States may be said to exist with the exception of Russia.

Europe's crude oil for refining comes largely from Persia, Mexico, Rumania, Poland, the United States, and in late years Venezuela.

The two outstanding tendencies in European refining are first, increasing participation and control of the industry by the respective governments and second, the shift to South America for crudes to supply a local refining industry and an increasing proportion of refined products as contrasted with the previous importations of refined products largely from the United States.

The first tendency is clearly noted in Spain, with the Spanish Petroleum Monopoly controlled by the government, in Italy where the federal government subsidizes and controls a large oil organization for "disciplinary effect," in France where imports are licensed and government participation in refining is still under discussion, in Poland, Rumania and Russia, which is, of course, 100 per cent government controlled.

The second tendency, the shift to South America for crude and refined products, is caused by the greatly reduced production in Mexico which formerly supplied large amounts of oil to Europe, and second, the reduced labor, refining and transportation costs of South American oil. It is also assisted



Today *and* Tomorrow

by the similarity in political and economic ideas found in the Latin peoples of both continents.

RECENT DEVELOPMENTS IN BRITISH PETROLEUM REFINING INDUSTRY

Recent developments in the British petroleum refining industry have been chiefly in the direction of improvement rather than of expansion. Some extensions have been made to existing plants, particularly in the addition of cracking units, but the total refining capacity of the country apparently is in the neighborhood of 30,000,000 barrels per year. Such additions as have been made to estimated refinery capacity are more or less balanced by a revision downward of preceding estimates, particularly in the case of the Anglo-Persian refinery at Llandarcy. The principal expansion has been the construction of a new refinery by Petroleum Refineries, Ltd., at Killinghilme, near Hull, Yorkshire, with a cracking capacity of 4,000 barrels per day. This plant is expected to be in operation during May, 1930, and will operate on the Gyro vapor-phase cracking process. The operating company, Petroleum Refineries, Ltd., has been organized for the purpose in conjunction with Low Temperature Carbonization, Ltd., and other interests, and, while petroleum will be treated in the ordinary way, the company expects to concentrate on the cracking of low temperature tars, expanding this phase of their operations as rapidly as the tar becomes available for treatment.

The British refining industry, as has been frequently pointed out, is an outstanding example of the development of extensive refining facilities at a considerable distance from the sources of crude oil supply. This is explainable by the very large market for petroleum products in Great Britain, which is the largest consumer in the world, outside of the United States, coupled with the lack of domestic supplies of crude petroleum. Local output of crude except for shale oil is limited to one well at Hardstoft in Derbyshire, which operates only intermittently, and the maximum production of which has been not

more than a few thousand barrels per year. There is, of course, a small but increasing supply of motor fuel (benzol) from coal, the output of this fuel amounting to about 32,000,000 imperial gallons in 1928, and 36,000,000 gallons in 1929. There is also a constantly increasing attention being given to the treatment of coal by low temperature carbonization processes, primarily for the production of a smokeless fuel, but incidentally for the recovery of liquid fuel, and more particular attention is being given to this latter phase, especially at the new refinery mentioned above. The imposition of a duty of 4d. per imperial gallon on imported light oils, and on light oils derived from imported crude oil, which was imposed in the Budget of 1928, provided some stimulus to the production of domestic oil from both coal and shale.

TREND BASED ON SUPPLY

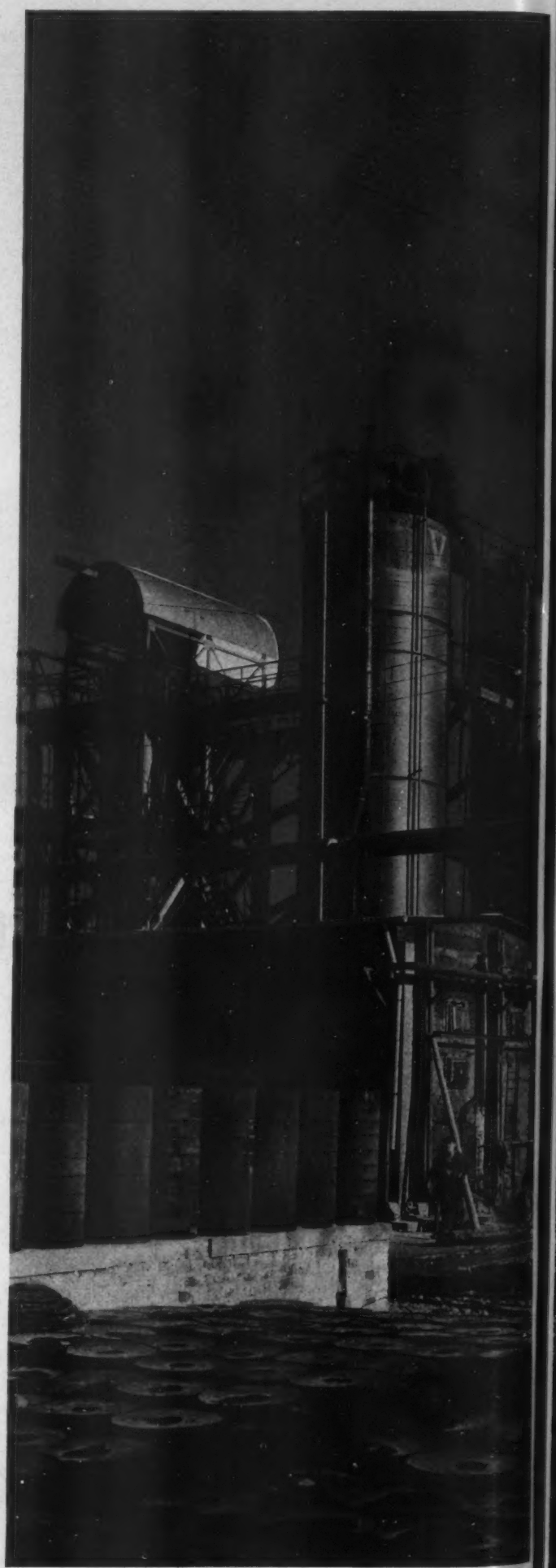
The trend of mineral oil refining in Great Britain in the near future will thus doubtless depend in some degree upon the progress which may be made in the commercial treatment of coal tars, but probably much more upon the development in the supply and prices of petroleum products from other sources. In this connection an interesting feature of the recent petroleum trade has been the increasing quantity of refined products imported from Persia, the chief source of crude for British refineries, and where Anglo-Persian Oil Company maintains a large refinery (at Abadan).

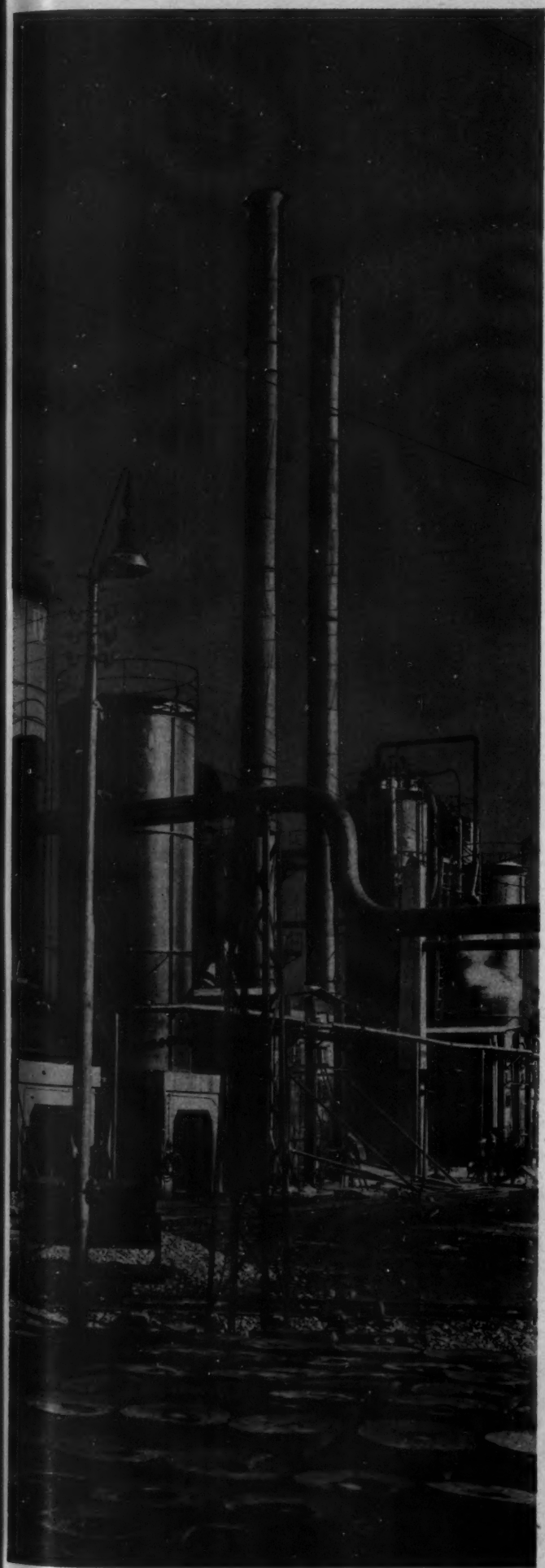
The following is a list of the principal refining plants in Great Britain:

Llandarcy, near Swansea, Wales.—Refinery owned and operated by the Anglo-Persian Oil Company (Ltd.) through a subsidiary, The National Oil Refineries (Ltd.), Brittanic House, Finsbury Circus, London, E. C. 2. Plant equipment is new and modern, including cracking plant. The source of its crude oil is Persia. Products manufactured are chiefly gasoline (motor spirit), kerosene for lighting and power purposes, Diesel and fuel oils, and wax. Lubricants are now being made on a relatively small scale; the output of these products is expected to increase. The reported capacity is approximately 7,000,000 barrels of crude oil per year, plus a "cracking" capacity of 1,300,000 barrels.

Grangemouth, near Edinburgh, Scotland.—Refinery controlled by Anglo-Persian Oil Company (Ltd.), through a subsidiary, Scottish Oils (Ltd.), 53 Bothwell Street, Glasgow (London office, Brittanic House, Finsbury Circus, E. C. 2.). Plant equipment is modern. Source of crude is Persia. Almost a complete range of products is manufactured. Capacity is estimated at 3,000,000 barrels per year, all crude oil.

Uphall, near Edinburg, Scotland. — Refinery controlled by Anglo-Persian Oil Company (Ltd.), through Scottish Oils (Ltd.). The capacity of the plant is about 900,000 barrels a year, and the prod-





ucts manufactured are similar to those at Grangemouth. No shale oil is used.

Fawley, near Southampton.—Topping and refining plant owned by Agwi Petroleum Corporation (Ltd.) 66-68, Haymarket, London, S. W. 1. Plant equipment is modern, including cracking plant. Sources of crude oil include Colombia, Venezuela, Mexico, and the United States. Products are chiefly gasoline, kerosene, fuel oil, gas oil, and asphalt. Reported capacity is approximately 3,250,000 barrels of crude oil per year.

Plants owned or controlled by Anglo-American Oil Company (Ltd.), are: Barrow-in Furness, Lancashire, capacity per annum 113,400 barrels; Silvertown, London, E., capacity 63,000 barrels; Purfleet, Essex, capacity 113,400 barrels; Barton-on-Irwell, Lancashire, capacity 63,000 barrels; Pacific Wharf, London, capacity 94,500-126,000 barrels.

Shell Haven, near London.—Refinery owned by Shell-Mex (Ltd.), (Royal Dutch Shell group), St. Helens Court, Great St. Helens, London, E. C. 3. Plant equipment is modern, including high-vacuum stills. At present Venezuelan crude is being treated. Products are gasoline, kerosene, lubricating oils, gas oil, fuel oil, asphalt, and various special products, including white spirit, cleaning naphthas, and bone-degreasing spirits. Capacity is about 2,500,000 barrels per year.

Stanlow, (Ellesmere Port) on Manchester Ship Canal, near Manchester.—Refinery is owned by Shell-Mex (Ltd.), (Royal Dutch Shell group). Plant equipment is modern. Its sources of crude are various, including Venezuela. Products manufactured include gasoline, kerosene, fuel oils, asphalt, white spirit, and special products. Capacity is 1,500,000 barrels per year.

Ardrossan, Ayrshire, Scotland (near Glasgow).—Refinery owned by Shell-Mex (Ltd.), (Royal Dutch Shell group). Plant ejuipment is modern. Products include gasoline, fuel oil, and asphalt. Capacity is about 750,000 barrels per year.

Thames Haven, near London.—Refining plant, consisting of one refinery and two topping plants, is owned by London & Thames Haven Oil Wharves (Ltd), 3 St. Helens Place, London, E.C.3. Plant equipment is mostly new and modern. Sources of crude oil are various. Products manufactured include gasoline, kerosene, and fuel oil. A lubricating plant is also reported to have been recently installed. Capacity is estimated at about 6,500,000 barrels per year. This refinery is understood to be operated for clients only, no refining being done on its own account.

HULL HAS 1000-BARREL PLANT

Hull.—Distilling plant, owned by Major & Co. (Ltd). Plant equipment was originally intended for distillation of coal tar, but fair quantities of crude oil are reported to have been treated. Products are gasoline, kerosene, gas oil, and fuel oil chiefly; other prod-

ucts in small quantities. Capacity is 1000 barrels per day, but no petroleum has been treated during the past year.

Isle of Grain, Kent, at the mouth of the Thames.—Cracking plant, owned by Medway Oil & Storage Co. (Ltd.). The plant was established in 1923; the equipment is modern. Sources of raw material are various but chiefly Russian. Products manufactured are gasoline, fuel oil, and special products, such as white spirit. Capacity is medium.

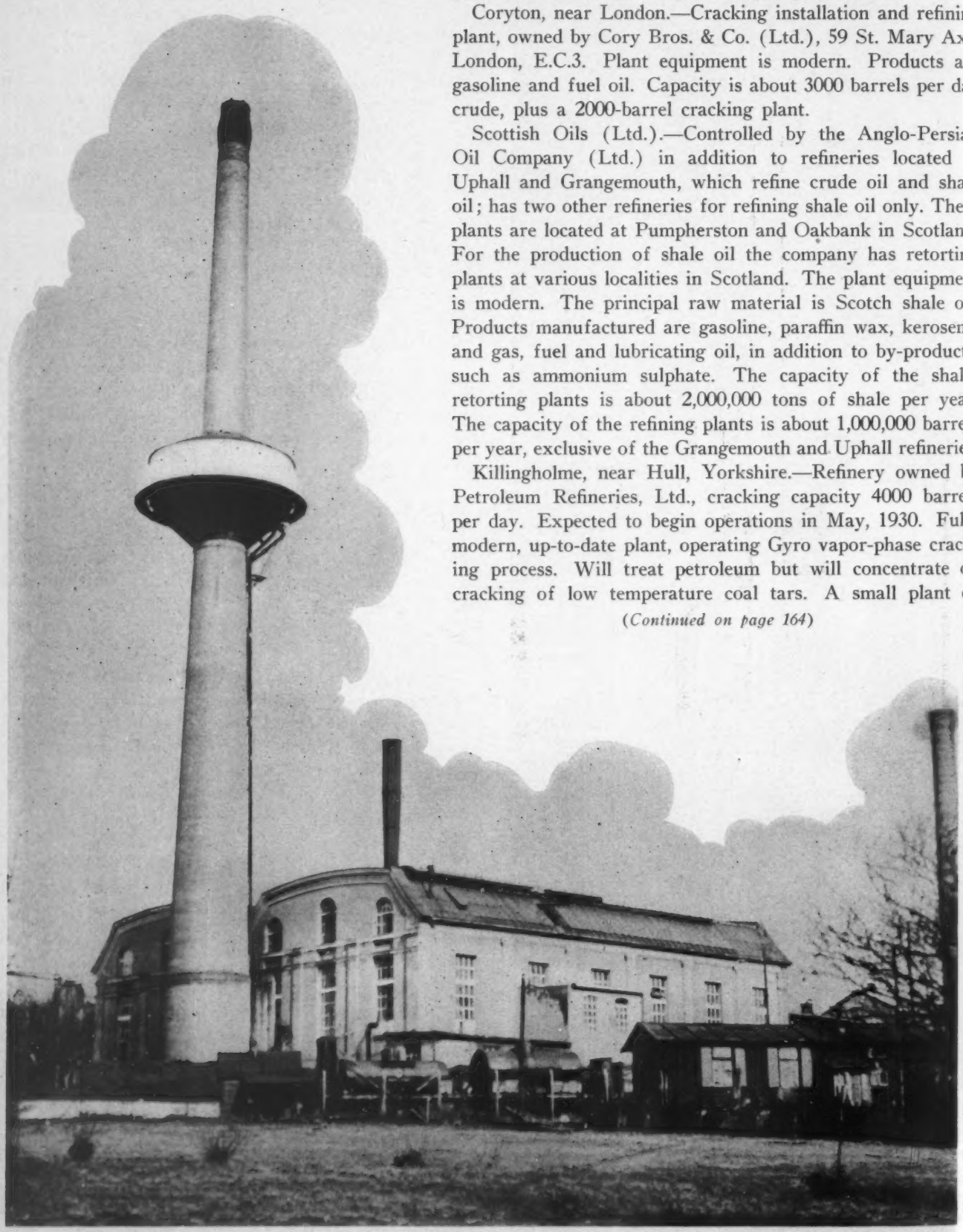
Coryton, near London.—Cracking installation and refining plant, owned by Cory Bros. & Co. (Ltd.), 59 St. Mary Axe, London, E.C.3. Plant equipment is modern. Products are gasoline and fuel oil. Capacity is about 3000 barrels per day crude, plus a 2000-barrel cracking plant.

Scottish Oils (Ltd.).—Controlled by the Anglo-Persian Oil Company (Ltd.) in addition to refineries located at Uphall and Grangemouth, which refine crude oil and shale oil; has two other refineries for refining shale oil only. These plants are located at Pumpherston and Oakbank in Scotland. For the production of shale oil the company has retorting plants at various localities in Scotland. The plant equipment is modern. The principal raw material is Scotch shale oil. Products manufactured are gasoline, paraffin wax, kerosene, and gas, fuel and lubricating oil, in addition to by-products, such as ammonium sulphate. The capacity of the shale-retorting plants is about 2,000,000 tons of shale per year. The capacity of the refining plants is about 1,000,000 barrels per year, exclusive of the Grangemouth and Uphall refineries.

Killingholme, near Hull, Yorkshire.—Refinery owned by Petroleum Refineries, Ltd., cracking capacity 4000 barrels per day. Expected to begin operations in May, 1930. Fully modern, up-to-date plant, operating Gyro vapor-phase cracking process. Will treat petroleum but will concentrate on cracking of low temperature coal tars. A small plant of

(*Continued on page 164*)

Power plant, Pechelbronn refinery, Pechelbronn-Merkwiller, Bas-Rhin, France.



Vapor Phase Cracking in England

By CAPTAIN W. McKECHNIE ROBSON

PETROLEUM Refineries Limited, a company with a capital of £470,000, has erected, on the south bank of the river Humber in England, a refinery to operate the Gyro Vapour Phase cracking process, under license obtained from the Gyro Company of Detroit. This plant has a capacity of 4000 barrels per day and is the first Gyro Vapour Phase cracking plant to be erected in Europe.

The process was introduced to England by Captain W. McKechnie Robson who has associated with him, in the formation of the above company, Colonel W. A. Bristow, who is the managing director of Low Temperature Carbonization Company, Ltd., the only company in England in actual commercial production in the low temperature carbonization field.

Captain Robson and Colonel Bristow are the joint managing directors of Petroleum Refineries Limited and are also the agents for the Gyro process in Europe.

The plant is erected on a 53½-acre site which includes 11½ acres of concrete on which the actual cracking units and some of the tankage are erected. The river Humber provides deep water for the navigation of tankers and barges and the plant is very well placed having regard to the very large market for its products in the Midlands and the north of England. At present storage accommodation amounts to about 45,000 tons. The refinery is complete in every respect.

CAPTAIN W. McKECHNIE ROBSON
Managing Director Petroleum Refineries, Ltd., London, England

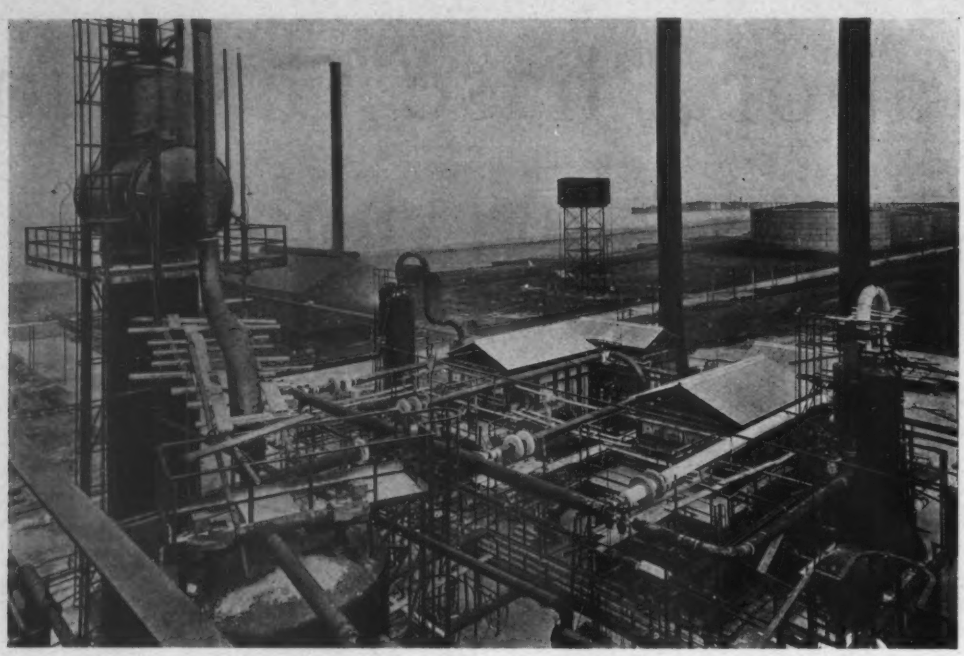
COL. W. A. BRISTOW
Managing Director of Low Temperature Carbonization Company, Ltd., and of Petroleum Refineries, Ltd., London, England

It has been found that the Gyro Vapor Phase cracking process is applicable to the oils obtained by the low temperature carbonization of coal, and while the company is operating on imported crude oils it is the intention of the directors to develop the coal oil side of the business as rapidly as possible.

Motor spirit made from domestic coal oils is exempt from the eight cents per gallon tax which is imposed on all motor spirit from other sources, and this will give an impetus to the utilization of the domestic coal oils.

HAS DEEP WATER FACILITIES

The refinery has deep-water loading and unloading facilities at the Admiralty jetty and a smaller in-shore jetty for shallow draught craft. The loading rack is



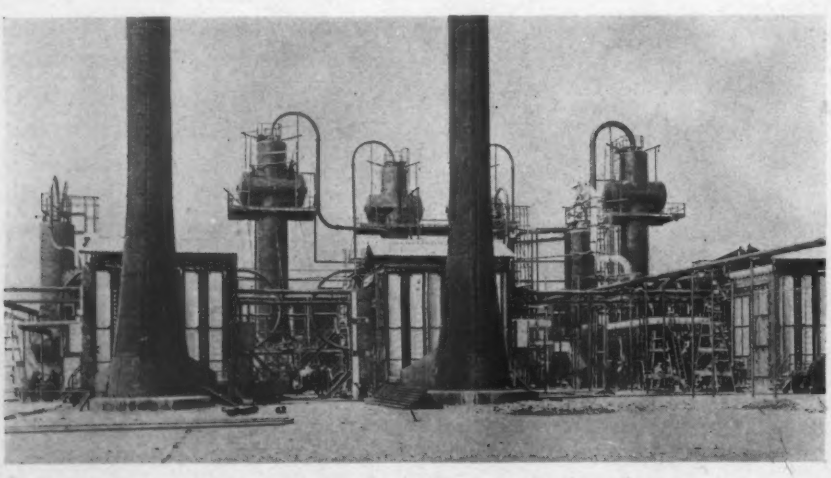
Two of the four converters erected at Killingholme, England. River Humber and loading pier in background

capable of dealing with the whole of the refinery output by rail tank cars, if so desired, and there is a total length of one mile of sidings connecting with the London and North Eastern Railway. The total oil storage capacity of the tank farm is approximately 12,000,000 gallons, the size of the storage tanks varying from 8000 tons down to 1500 tons. This capacity permits elasticity of working and the holding of large reserves of oil so that there is no danger of work being retarded through intermittency of supply.

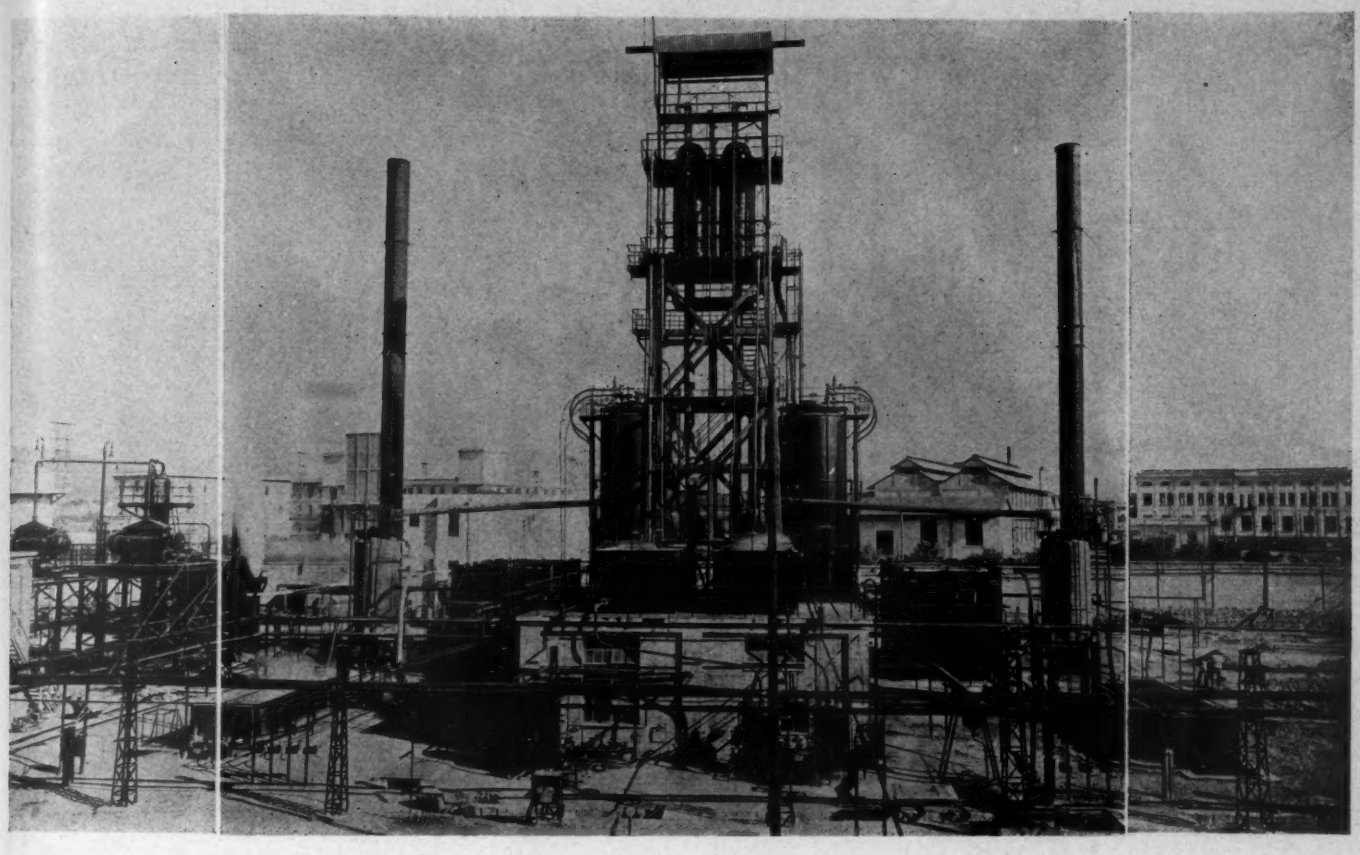
A separate system allows for the rerunning and refining of the endpoint first distillate, and a separate system, largely dependent on heat exchange and with a separate fractionating column of its own, is used for topping straight-run petrol from the crude oil employed.

The Killingholme refinery is self-contained and is fully equipped with all accessory and auxiliary plant necessary for complete operation. The refinery makes its own electrical power and has its own water supply. Cooling water for condensers, etc., is obtained from a surface water reservoir and boiler water from an artesian bore. The laboratories are well equipped and there are ample stores and storage space and office accommodation.

The plant operates practically at atmospheric pressure, and has, therefore, a large factor of safety; the plant is simpler than many types of cracking units, obviating "high pressure" engineering, so that maintenance costs are low; a wide range of materials can be used without disturbing the uniformity of the products; and the installation can be used as a topping and cracking plant combined, as well as for cracking alone.



Gyro units number 3 and 4 at Killingholme, England, just after completion, operation being on oils obtained by low temperature carbonization of coal or on crude oil distillates or residues



Italy Is Building an Oil Industry Based on Cracking

By GUSTAV EGLOFF
Universal Oil Products Company

ITALY, under the guidance of Mussolini, is going farther to establish an independent oil industry of its own than any other European country which has no production of crude oil within its borders.

This is being done by installing cracking plants at strategic points and building great, underground, concrete reservoirs for the storage of fuel oil and other cracking stocks.

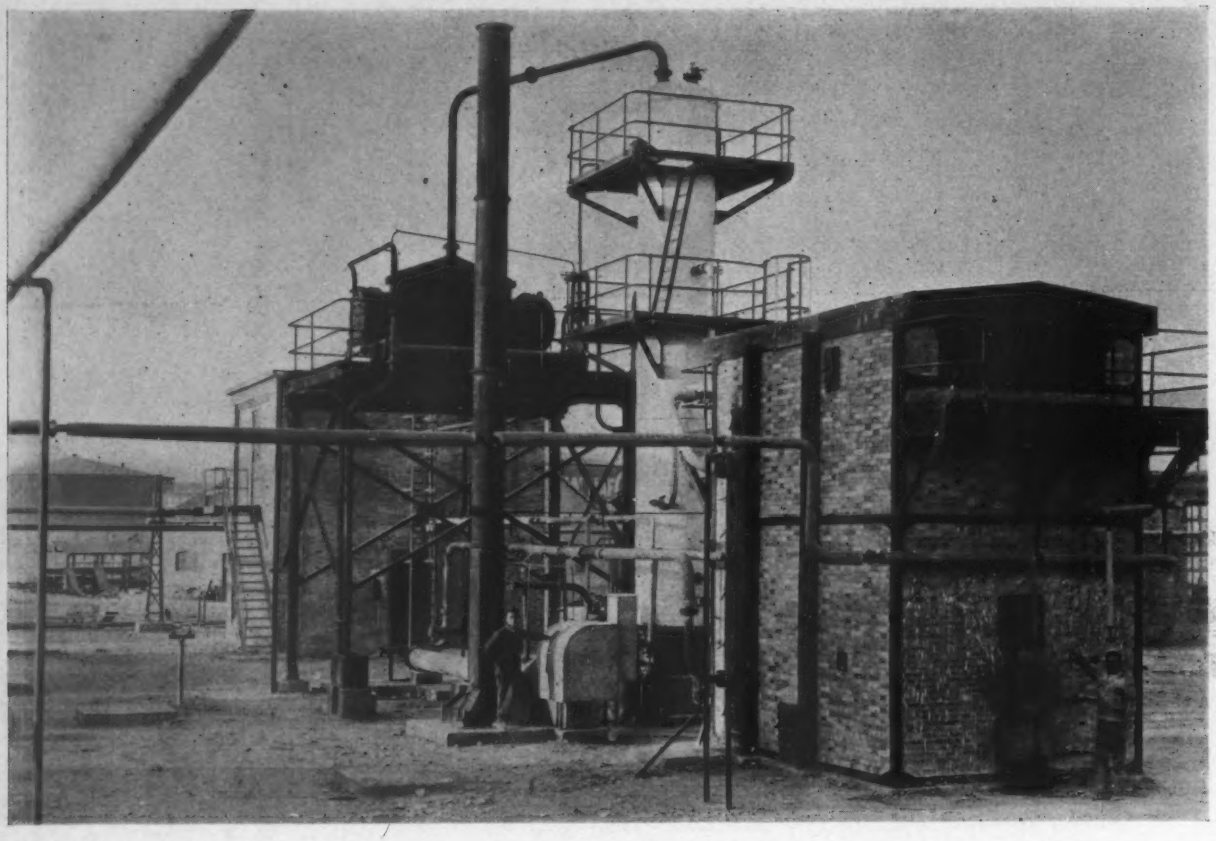
This plan provides for the storage in quantity of only the heavy oils, with practically no loss on evaporation, and small fire hazard. At any time they can be converted by cracking into gasoline.

In carrying out this program, within the past year two Italian companies have installed cracking units. Another cracking plant is now in course of construction. More oil tanks are also being built.

Conditions just at this time are particularly favorable to the development of these Italian plans. Almost unlimited quantities of fuel oil or heavy crudes are available from Russia and from Rumania. Conditions prevailing in Rumania are particularly favorable for outside buyers just now.

It is fact, testified to by leading Rumanian oil men, that many refineries and producers in that country are practically at a standstill because fuel oil and heavy crude have filled available storage and it is too costly to build additional tanks, in view of the low value of heavy oils.

I was told on good authority, while in Europe, that some Rumanian refining companies and producers, not only are not selling their fuel oils and heavy crudes, which are a drug on the market, but are actually paying other interests to haul these stocks away from their plants, or are burning them to avoid storage charges. This condition, of course, works greatly to the advantage of Rumanian refiners who have cracking



Newly completed distillation unit at Benit Societa Anonima Benzin, Italiana, Naples, Italy

equipment, and also to the advantage of Italian interests who are purchasing oil.

ITALIANS ACTIVE

The activity of the Italians in building up their cracking industry was provoking a great deal of discussion at the time of my recent European visit. This discussion has reached the United States, as is shown by a pithy statement in "Time" of August 18, 1930.

This statement indicates that the Russian Soviet and Italian governments are working together on the Italian oil program, and that the size of the market thus afforded is regarded by the Soviets as important enough to justify the establishment of a branch office in Italy.

Much of the oil going into Italy is reported to be furnished through the Russian Soviet Oil Trust "Azneft." This is indicated by the article in "Time," which states in part:

"The chief weakness of Italy's war machine is her great lack of coal and petroleum in commercial quantities. It is known that the Soviet Naphtha Syndicate of Moscow, official distributor of Soviet oil, has set up a subsidiary company in Italy, known as Petrolea. Observers guessed that Petrolea will be given the job of stocking the enormous oil reservoirs which Italy's army and navy are now building."

While it is realized that great supplies of cheap oil may not be always available from Rumania and Russia, it is generally agreed that fuel and heavy crude oils will be available in large supply for many years to come at a price which will make profitable the production of gasoline by cracking. The United States, Mexico and South America also have tremendous supplies which can be drawn upon when needed.

While the general impression is that Italy's oil storage and cracking campaign originated primarily as a national defense measure, it is presumed also that Mussolini is keenly alive to the advantages of building up the manufacture of gasoline as a peace-time industry.

The use of automobiles and airplanes is increasing steadily in Italy, and it will be simple to provide motor fuel to take care of this increase by building more cracking units.

The cracking process is adaptable not alone to petroleum oils, but also produces gasoline from shale oils, tar oils and any other hydrocarbons, in the remote contingency that supplies of petroleum oil should fail.

NOW CRACKS 7500 BARRELS DAILY

The daily cracking in Italy is now estimated at about 7500 barrels. The principal cracking plants in operation are at Spezia and Naples. Another cracking installation is now building at Venice. These units were designed for great flexibility of operation, to run either on the residuum or the non-residuum system, on light or heavy distillate, residual oils or crude oil. The same type cracking units which are running on Rumanian oil are also operating on Russian stocks, and these units are adapted to operate on any oil in the world. It

is understood that still more cracking plants are to be erected in Italy.

From the Rumanian fuel oil about 50 per cent of gasoline of 397°F. endpoint is being obtained, and from Russian Mazut, through the non-residuum method of cracking, yields over 51 per cent gasoline of 392° end point. Using the flashing operation, covering 32 continuous days, the yield of gasoline was 38.5 per cent of 406° F. end point.

The general characteristics of the oil imported from Rumanian and Russia into Italy, and detailed summaries of cracking runs upon it, are as follows:

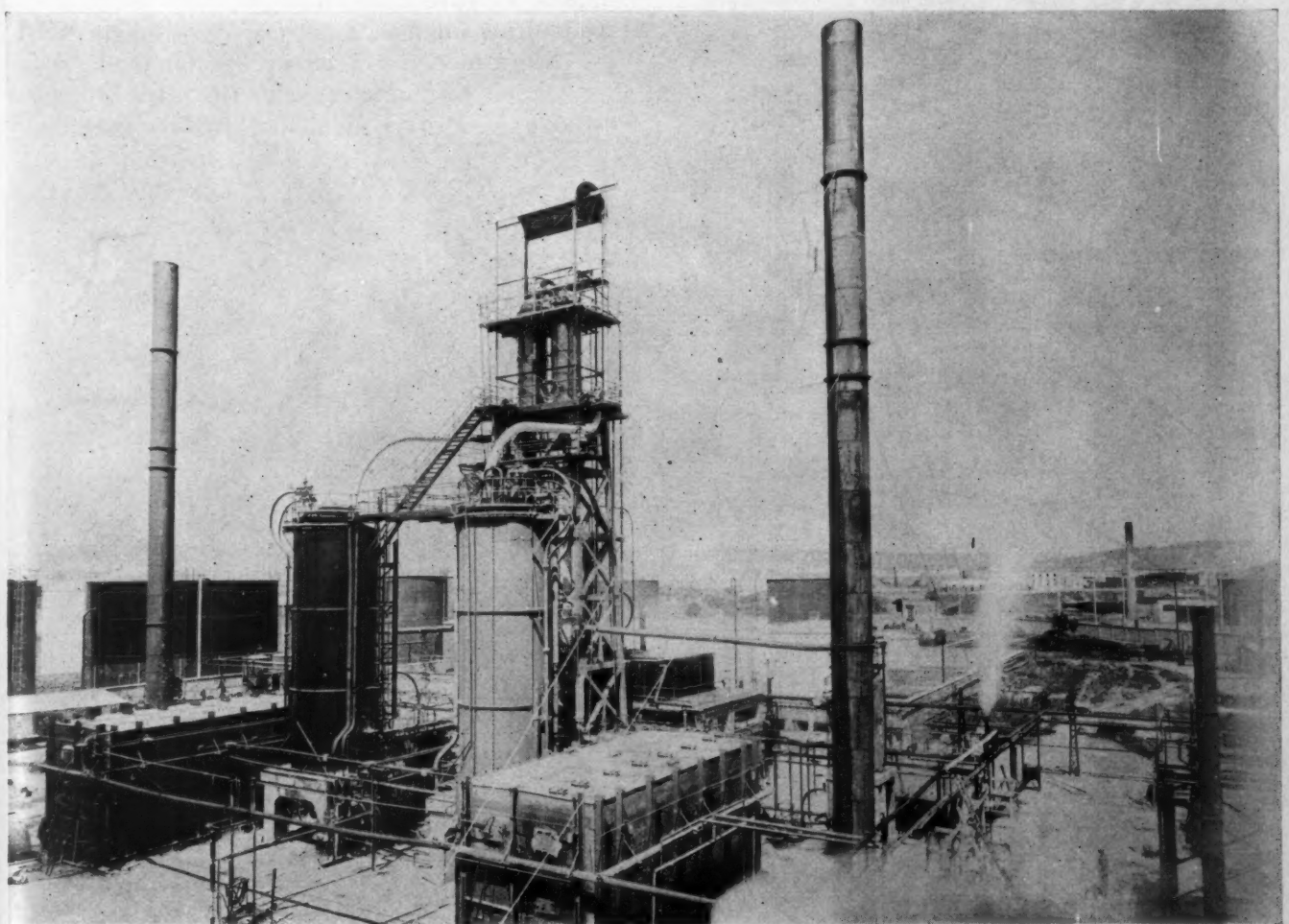
	Russian Paraffin Base Mazut (Fuel Oil)		Rumanian Pacura (Fuel Oil)
A.P.I. Gravity	23.1	24.7	23.6
Distilled over at 572°F.	10%	11%	4%

Data for Typical Commercial Cracking Runs

	Flash Operation	Coking or Non-Residuum Operation	Coking or Non-Residuum Operation
Time on stream	32 days	2.8	2.7
Total fuel oil cracked (bbls.)	35,469	2400	3444
Fuel oil (bbls. per day)	1,110	875	1250
Cracked distillate	636	670	912
A.P.I. gravity cracked distillate	50.8	52.3	54.5
Per cent fuel oil	57.4	76.6	72.9
Cracked residue (bbls. per day)	414	0	0
Per cent of fuel oil	37.3	0	0
Coke (lbs. per bbl.)	0.0	57.3	91.1
Gas, coke and loss	5.3	23.4	27.1
Gasoline (bbls. per day)	426	450	618
Gasoline—per cent of fuel oil (406°F. end point)	38.4	51.5	49.4
A.P.I. gravity	57.2	57.5 (392°F. end point)	58.4 (397°F. end point)
Cracked distillate bottoms (bbls. per day)	172	172	258
Per cent of fuel oil	15.4	19.7	20.5
A.P.I. gravity	31.1	32.1	34.8
Operating Conditions			
	°F.	°F.	°F.
Transfer liquid	914	936	927
Furnace (above tubes)	1,508	1,526	1,472
Furnace (below tubes)	1,148	1,076	1,148
Vapors to dephlegmator	846	860	874
Combined feed	770	788	784
Vapors to condenser	689	518	480
Unflashed residuum	743	...	...
Flashed residuum	680	...	...
Operating pressures (lbs. per sq. in.)	170	200	140

Other European countries which are without their own crude oil production are watching intently the working-out of the Italian program and are seriously considering the application of such a program to their own conditions.

For countries possessing crude oil the cracking process is essential for the economic utilization of their resources. But to countries without petroleum oil of their own, cracking is even more important. The rapidly increasing use of motor vehicles both in the pursuits of peace and in national defense demand supplies of gasoline. Storage of heavy oil and use of the cracking process is the most economical and assured way of providing gasoline for ordinary needs and guaranteeing it in emergency.

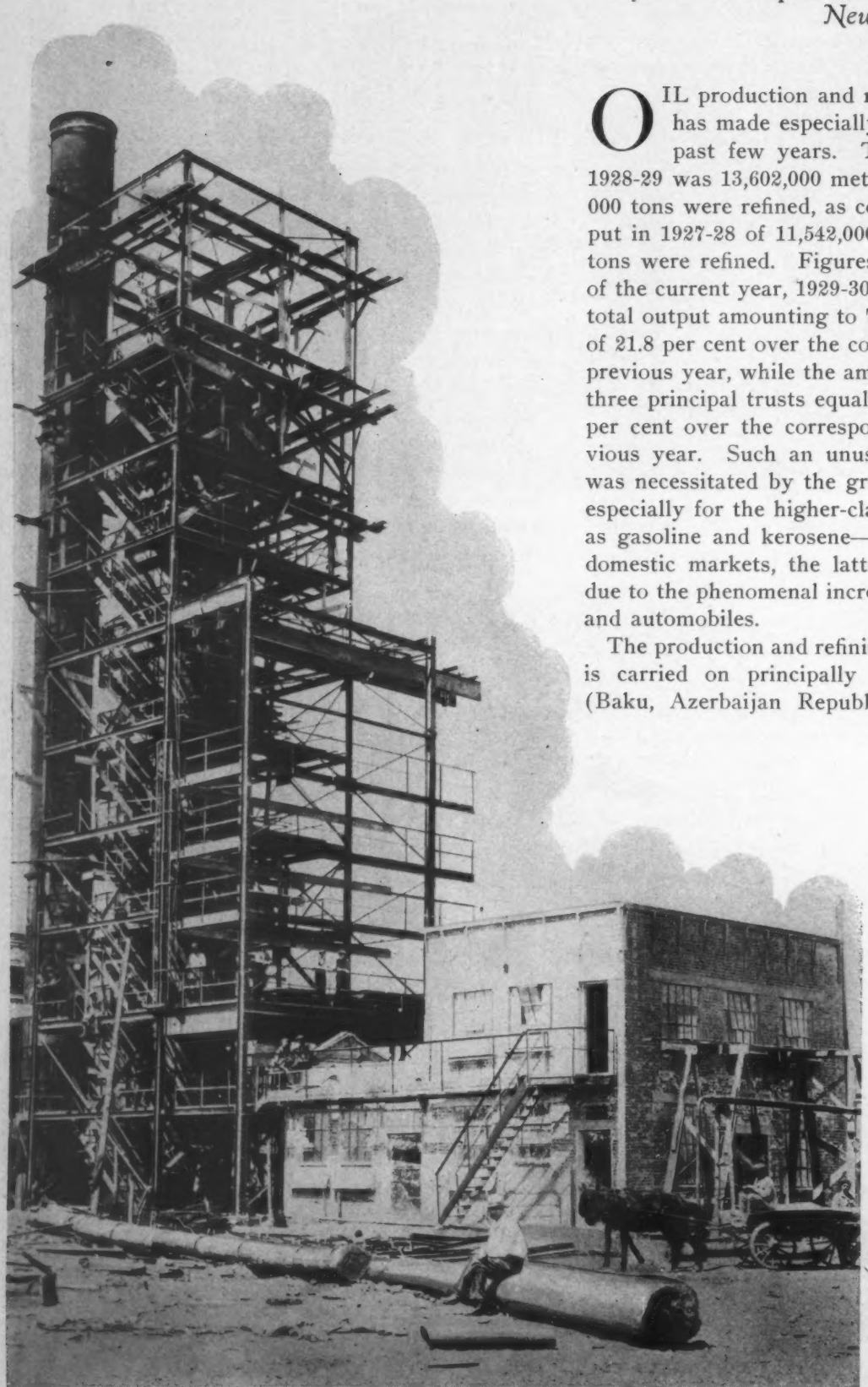


Oil Refining

By S. S. SHIPMAN
Information Department Amtorg Corporation, New York

OIL production and refining in the U. S. S. R. has made especially rapid strides during the past few years. Thus, the total output in 1928-29 was 13,602,000 metric tons, of which 10,721,000 tons were refined, as compared with a total output in 1927-28 of 11,542,000 tons, of which 8,781,000 tons were refined. Figures for the first six months of the current year, 1929-30, show a further gain, the total output amounting to 7,600,000 tons, an increase of 21.8 per cent over the corresponding period of the previous year, while the amount of oil refined by the three principal trusts equalled 6,581,000 tons, or 28.5 per cent over the corresponding period of the previous year. Such an unusually rapid development was necessitated by the great increase in demand—especially for the higher-class refined products, such as gasoline and kerosene—both by the foreign and domestic markets, the latter demand being largely due to the phenomenal increase in the use of tractors and automobiles.

The production and refining of oil in the U. S. S. R. is carried on principally by two trusts: Azneft (Baku, Azerbaijan Republic), which accounts for



Plant No. 1, Grozny Oil Trust, Grozny, U. S. S. R., Russia, nearing completion

In The Soviet Union

about two-thirds of the country's output; and Grozneft (Grozny, in the North Caucasus), which produces about 30 per cent of the total. Small quantities of petroleum are also produced in a number of other fields, the most important of which are: the Emba Region in Kazakstan, the Kuban field, Uzbekistan and Turkmenistan in Central Asia, and the Island of Sakhalin in the Pacific. In order to unify and promote planning, production, and sales of the oil industry as a whole, a central body, known as Soyuzneft (United Oil Industry), was organized early this year.

At the time the oil industry of the U. S. S. R. was nationalized, in May, 1920, it was at a very low ebb. Wasteful methods of exploitation in the pre-war period, followed by the destruction and disorganization wrought by the war and interventions, had resulted in the practical disruption of the oil industry. The oil fields and refineries were lacking in the most necessary equipment and supplies, in skilled workers, means of transportation, and finances. Oil refining was especially neglected. The main products were mazut (fuel oil) and kerosene. Gasoline was produced in insignificant quantities, while automobile lubricants were not produced at all. The methods employed in refining were primitive. Pipe stills, cracking plants, plants for producing bright stocks were unknown. The civil war wrought havoc with the buildings and equipment of the few existing refining plants.

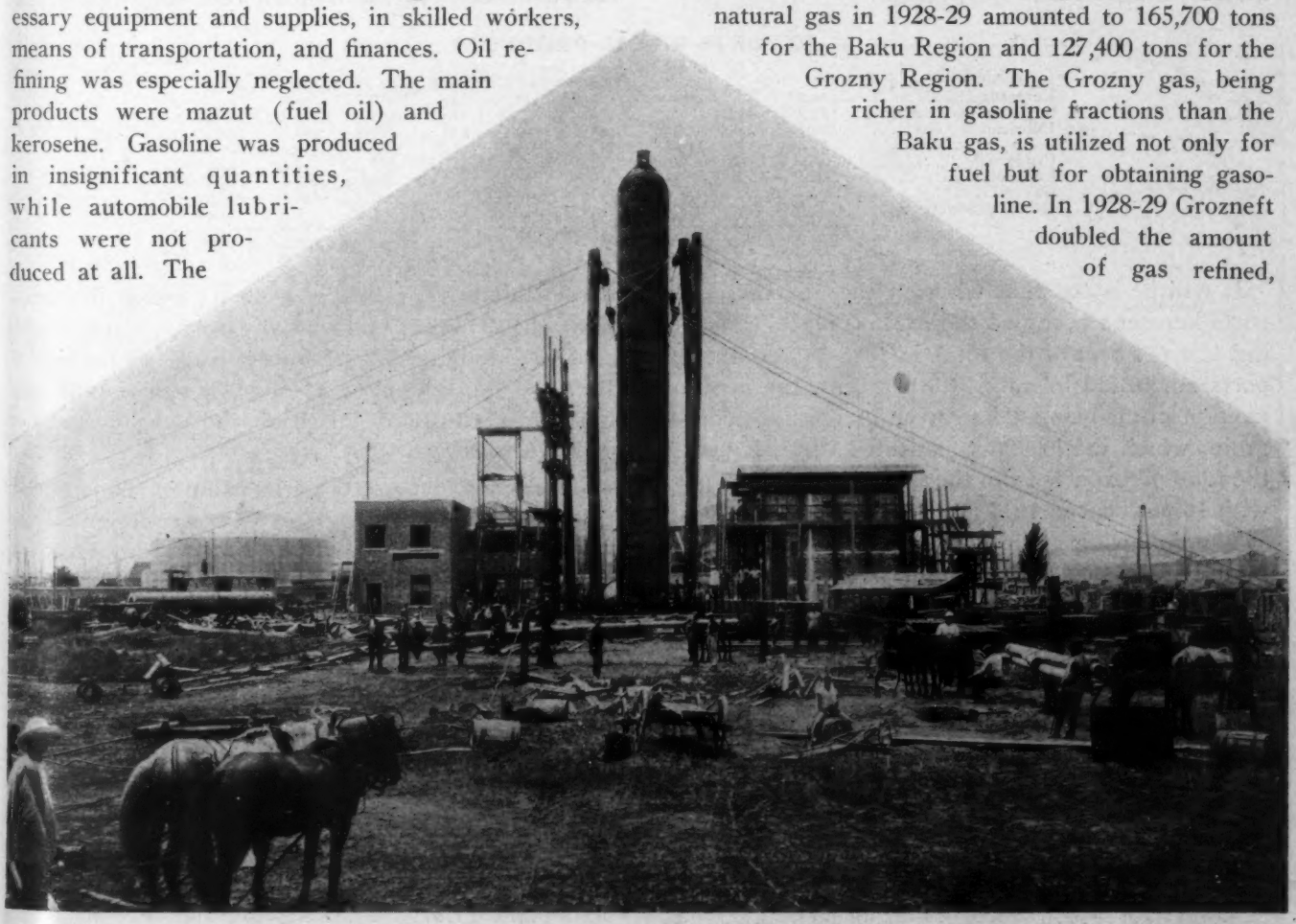
Production made slow gains during the first years after nationalization, but beginning with the fiscal year 1924-25 progress has been steady, both as regards total production and the amount refined. This is clear from the following table:

AMOUNT OF OIL REFINED

(In thousand metric tons)

	1913	1924-25	1925-26	1926-27	1927-28	1928-29
Baku	4,554.5	3,035.2	3,458.4	3,988.0	5,278.0	6,406.0
Grozny	946.4	1,674.6	2,187.3	2,657.3	3,182.0	3,944.0
Emba	151.7	130.1	141.4	208.0	229.0	226.0
Kuban and other fields	49.8	84.9	88.9	90.0	91.0	145.0
Total refined	5,702.4	4,924.8	5,876.0	6,943.3	8,781.0	10,721.0
Total oil production	8,922.9	6,985.9	8,246.0	10,198.8	11,542.0	13,602.0
Ratio of refined to total oil production (in per cent)	63.9	70.5	71.3	68.1	76.1	78.8

In addition to the crude oil output, the output of natural gas in 1928-29 amounted to 165,700 tons for the Baku Region and 127,400 tons for the Grozny Region. The Grozny gas, being richer in gasoline fractions than the Baku gas, is utilized not only for fuel but for obtaining gasoline. In 1928-29 Grozneft doubled the amount of gas refined,



Plant No. 2 — With fractionating column in place and tube still completed at Grozny Oil Trust refinery at Grozny, Russia

obtaining therefrom 28,400 tons of light gasoline, which when mixed with ligroin[1] (in a proportion of 1 to 3) added 70,000 tons to the gasoline output of Grozneft.

The total production of oil in the U. S. S. R. for the first six months of the current year, 1929-30, amounted to 7,666,000 tons, of which over 86 per cent was refined. Though there has been a steady increase in the percentage of oil refined, it is far from keeping pace with the exceptionally rapid increase in demand for refined products both on the foreign and domestic markets.

The extensive introduction of modern refining methods and equipment dates from the fiscal year 1924-25. At that time the rapid growth in oil output began to exceed the capacity of the refineries and the increased demand on the part of the domestic market for tractor fuel and the prospects for the profitable sale of large quantities of gasoline abroad called for an increase in the capacity of the refineries and a much greater production of gasoline. It was found necessary not only to restore and re-equip the old plants, but to construct new ones and to organize production on an entirely new basis.

The rapid growth in importance of gasoline in the oil industry of the Soviet Union may be judged from the following table of oil exports:

DOMESTIC MARKET RESPONDS

The domestic market also shows a growing demand for the higher class oil products. Thus the sale of lubricating oils in 1928-29 has increased over 40 per cent as compared with 1927-28, that of gasoline 32 per cent, and that of kerosene 30 per cent. The sale of other less valuable products has increased at a lesser rate. This increased demand for the higher-class oil products on the domestic market is due mainly to the phenomenal progress in the mechanization of agriculture, involving a stupendous growth in the number of tractors and also to the rapid increase in the number of automobiles and trucks.

In an effort to meet these increased demands both at home and abroad, it has been necessary to increase the gross production of oil, the proportion refined, and especially the proportion of gasoline and other higher-class oil products. Rapid progress has been made in this last direction during the past few years. While before the war gasoline constituted less than one per cent of the refined oil output, by 1926-27 it constituted 9.8 per cent, and in 1928-29 it made up 12.7 per cent. This increase was attained almost exclusively by improvement in the methods of direct distillation, since the cracking process up to the past year occupied a minor role, only two cracking installations (Vickers system) being in operation, one at Baku and one at Grozny, with a total capacity of about 250,000 tons a year. From 1923 to 1927 the proportion of gasoline, kerosene, and lubricating oils to the total refined oil output increased from 26 to 39 per cent.

EXPORTS OF OIL PRODUCTS

(In thousand metric tons)

	1913	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27	1927-28	1928-29
Kerosene	440.2	60	190	373	427	341	474.7	706.5	781.5
Gasoline and ligroin	152.2	43.8	41	134	277.2	410	605.5	771.4	1,037.4
Lubricating oils	238.7	35	41	84	102.1	139	167.8	197.4	198.5
Solar oil	51.0	1.5	18	47.2	80.2	50	30.7	50.5	66.1
Crude oil	...	...	32.2	72.3	61.9	110.1	127.2	155.8	155.8
Fuel oil	65.6	0.2	4.8	39.0	391.4	359.9	550.0	699.7	1,128.8
Gas oil	...	...	...	...	37.2	104.	125.0	205.3	256.6
Other products	...	...	...	...	...	...	...	1.0	1.2
	947.7	140.5	327.0	749.5	1,377.0	1,514	2,080.9	2,787.6	3,625.9

It will be noted that while in the pre-war oil exports kerosene occupied the leading place, constituting 46.4 per cent of the total, in 1928-29 kerosene exports amounted to only 21.6 per cent, the predominant position being taken over by gasoline and ligroin, which in 1928-29 constituted 28.6 per cent of the total oil exports from the U. S. S. R., as compared with 16 per cent in 1913 and 12.5 per cent in 1922-23.

The following table shows the sales on the domestic market of Soviet oil products for the past three years:

	1926-27	1927-28	1928-29
	(In metric tons)		
Gasoline	76,900	98,300	129,400
Kerosene	1,018,200	1,189,700	1,567,700
Gas and Diesel oil	606,800	672,500	748,700
Lubricating oils	159,600	198,700	288,800
Fuel oils	3,863,200	4,434,500	4,825,000
Miscellaneous	199,500	212,600	217,200
Total	5,924,200	6,806,000	7,776,800

In order to increase the proportion of refined products, an extensive program of construction of refineries is being carried out. Among the many refining plants put into operation during 1928-29, in addition to the two cracking plants already mentioned, the most important are the following:

By **Azneft**: Three pipe stills for kerosene and gasoline—one of American construction (Graver system), productive capacity 410,000 tons a year; two of German construction (one Pintsch and one Wilcke system), productive capacity 200,000 tons each; two batteries of nine stills each, productive capacity of 368,000 and 328,000 tons, respectively; one sulphuric acid plant (Lurga system), productive capacity of 8000 tons sulphuric acid.

By **Grozneft**: One battery of 15 stills; two pipe

[1]Ed. Note—Ligroine—ligroin—a volatile inflammable liquid used as a solvent in chemistry and pharmacy and to a limited extent as an illuminant. Sp.G .71-.73 (67-62 deg. Baume). Boiling Point 80-120 deg. Cent. (176-236 deg. Fah.)—Webster's New International Dictionary.

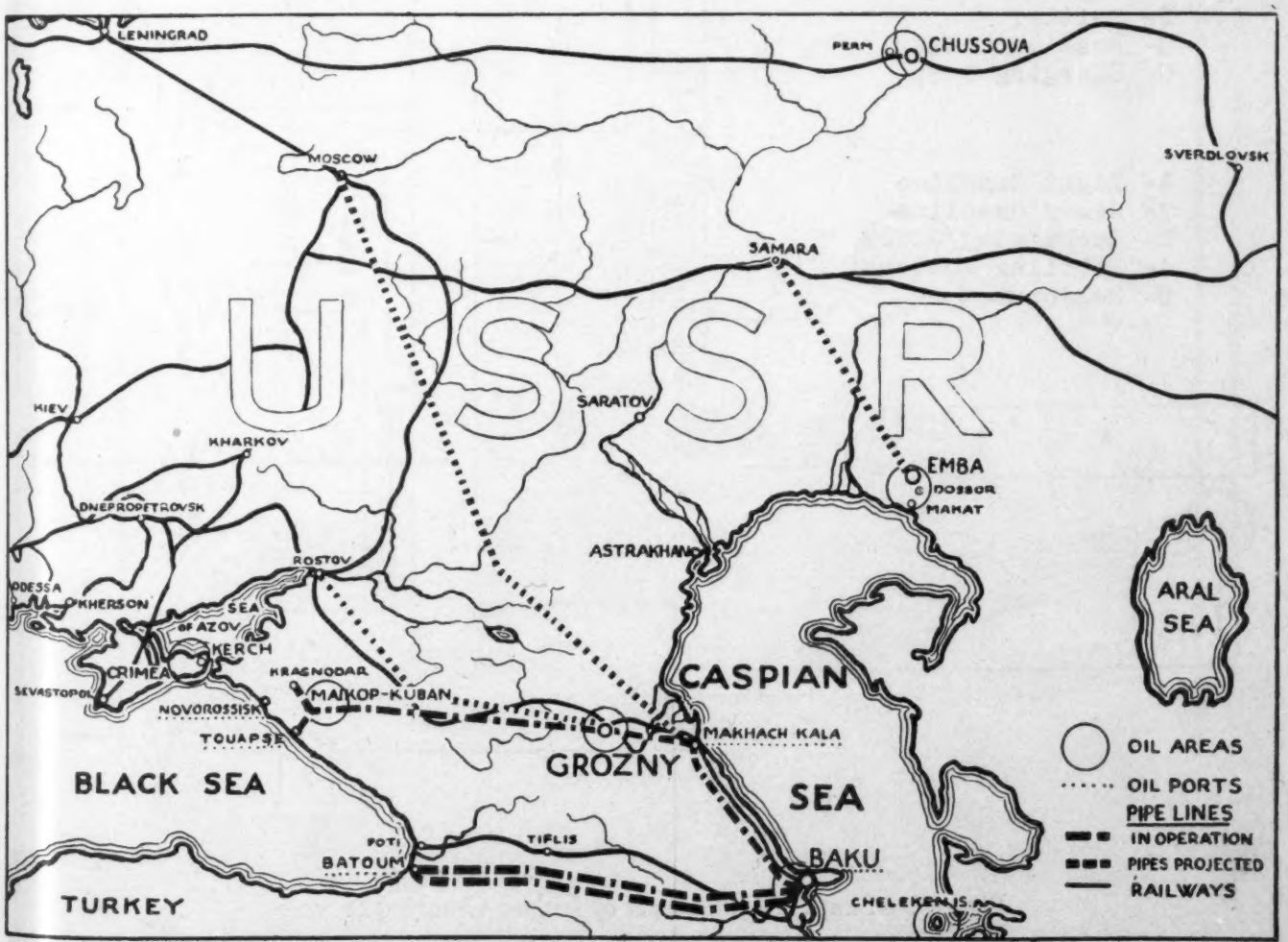
stills (Borrman system). In addition, two pipe stills began operation in July, 1930, with a daily capacity of 1000 and 2000 tons respectively. The larger still will produce more than 400 tons of gasoline-ligroin fractions daily.

OUTPUT INCREASED

The construction of these new plants has resulted in an increased output of refined products during the current year. The output for the Baku refineries will amount to 6,952,000 tons as compared with 6,404,000 tons in 1928-29. This was brought about mainly by increased capacity for direct distillation, and is fairly satisfactory as far as the sum total of refined products is concerned, but has not produced the desired results as regards increase in the production of gasoline. Though this has been due in part to the changer character of the oil refined, in Baku—heavier grades; in Grozny—oil with high paraffin content and low in light-oil fractions), it must be laid mainly to the fact that the required increase in gasoline output cannot be attained by means of direct distillation alone. In order to meet the rapidly growing demand for gasoline, reliance must be placed on the development of the cracking process. The oil trusts of the U. S. S. R., realizing this, have placed on the program for the current year the construction of 14 new cracking plants. The construction plans for 1930-31 call for over 100 cracking plants, and also for over two score pipe stills and refineries, 400 coke ovens, etc. By the end of the five-year period (1932-33), it is planned to have constructed cracking plants with a total capacity of 18,000,000 tons. Much of the equipment for these plants will be purchased from the United States.

The basic trend in the future development of oil refining in the U. S. S. R. is that of increasing to the maximum the extraction of gasoline and kerosene from crude oil. The necessity for this is clear from the following: The production of kerosene and gasoline during the course of the five-year period, 1928-29—1932-33, must be increased 145 per cent in order to keep pace with the demand, whereas the crude oil resources permit of an increase in the amount of refined oil during the same period of only 110 per cent. It is therefore necessary to increase the proportion of gasoline and kerosene in the total amount of oil refined. It is proposed to bring this proportion by the last year of the five-year period up to 46 per cent for the Soviet Union as a whole and to 65 per cent for the Baku fields. This considerably exceeds the present American figure. The total output of gasoline in the last year of the five-year period

(*Continued on page* 144)



Sketch map showing the principal oilfields of the U. S. S. R.

Tariff Encouraging Refinery Building in Belgium

THE recently enacted Belgian tariff on crude oil and refined products is a serious inducement for the development of a local refining industry.

While crude oil enters the country on the free list, imported gasoline pays 70 centimes per liter, or 7.5 cents United States currency per gallon. On the other hand, gasoline manufactured in Belgium pays an internal revenue duty of 35 centimes per liter only or 3.75 cents per gallon. This would leave a gross margin of profit of almost four cents per gallon for the local refiner, provided he could manufacture gasoline in Belgium on a competitive basis with the imported product.

Disregarding a very small unit, built by an Electric Power Company more for experimental purposes, the

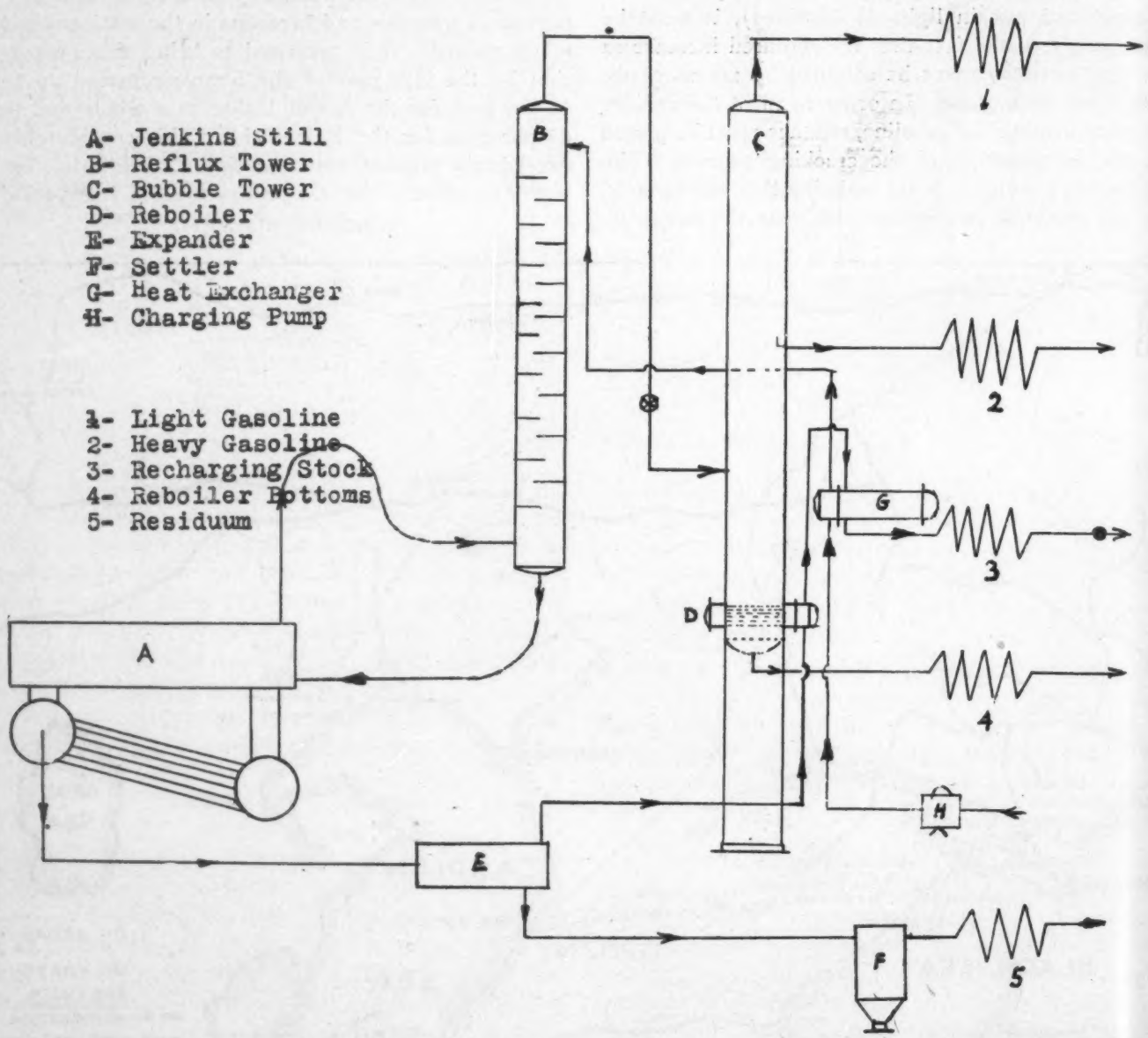


Figure 1—*Simplified flow sheet of Jenkins Cracking Process*

Emeric Kroch, D.Sc., who had charge of construction of Belgium's most modern refinery

first commercial cracking plant in Belgium has been recently completed by the Raffinerie Nationale de Petroles, a Belgian enterprise.

Anglo Belgian Petroleum Company, Ltd., acted as general contractor, while Graver Corporation did all the engineering work and Foundation Company of Belgium, the actual construction work.

The following description of the plant has been given by Emeric Kroch, D.Sc., who has been in general charge of the erection of the plant for Anglo Belgian Petroleum Company, Ltd., and Raffinerie Nationale de Petroles S. A.

THE PLANT

The plant is located on the deep water canal from Ghent to Terneuzen and occupies an area of approximately 24 acres. Only 60 per cent of the above site has been occupied by the present plant layout, the balance having been set aside for future development and employes homes.

The nucleus of the plant is a Jenkins cracking still of the new and improved Type 5A design.

The flow sheet on Figure No. 1 shows the principle of this arrangement when cracking low gravity Mid-Continent or Texas crudes. The flow sheet is self explanatory; besides, the Jenkins process having been

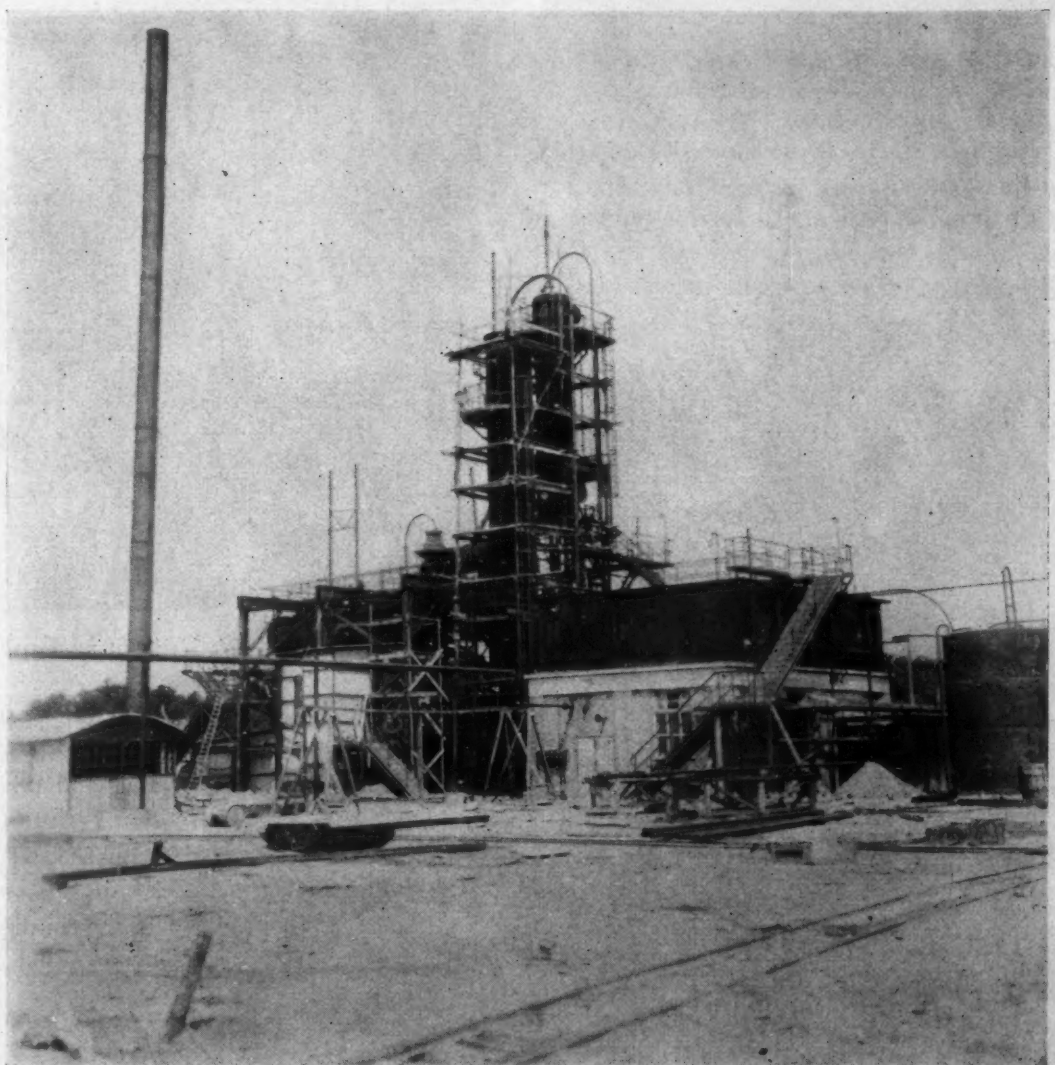


Figure 2—Jenkins still at plant of Raffinerie Nationale de Petroles, the most important Belgium refinery

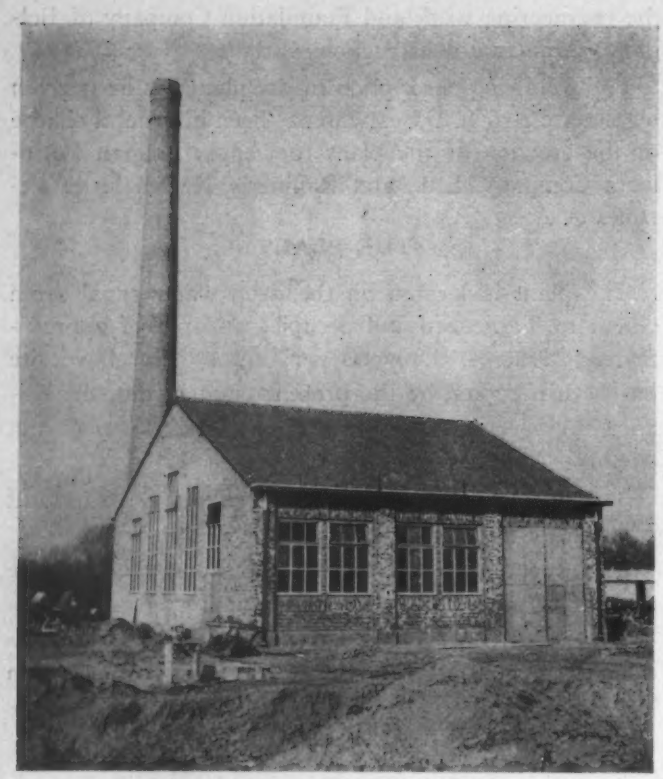


Figure 3—*Boiler House*

described elsewhere, there is no necessity of going deeper into this matter.

The rest of the plant is designed for the purpose of making a high grade, low end point gasoline from the Jenkins pressure distillate and ample provision has been taken care of for the rerunning, fractionating, treating and blending of the raw product.

Figure No. 2 gives a view of the Jenkins still during the last stage of erection.

Adjacent to the Jenkins still is a boiler house built as customary in Belgium, very substantially in form of a brick building with a steel truss roof covered with tile. The boiler house (shown on Photo. No. 3) contains two 150 B.H.P. boilers of the corrugated flue tube design. This type of boilers has been selected on account of the feed water that has to be used. Steam not being used to any extent for operating purposes,

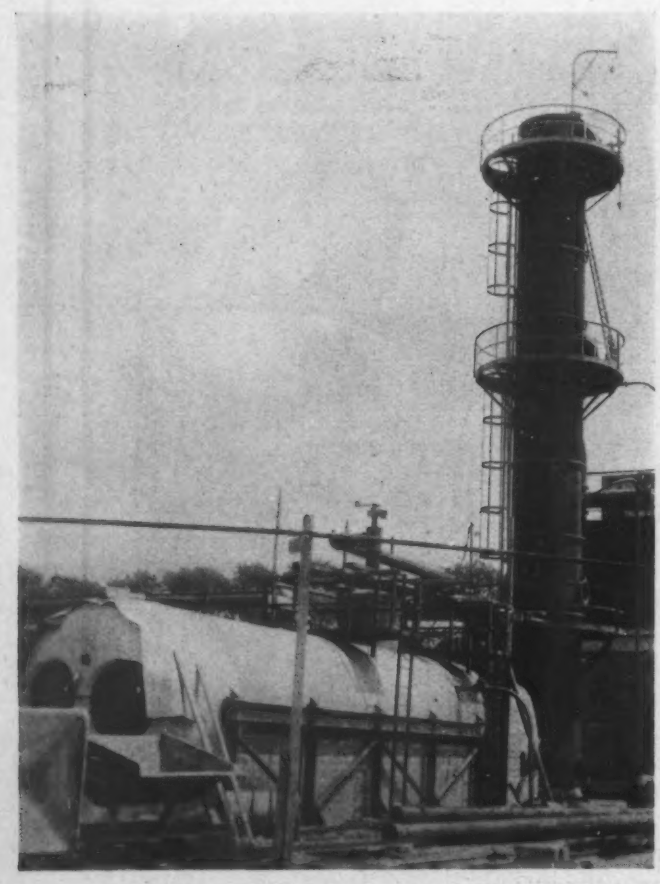


Figure 4—*Re-run Still*

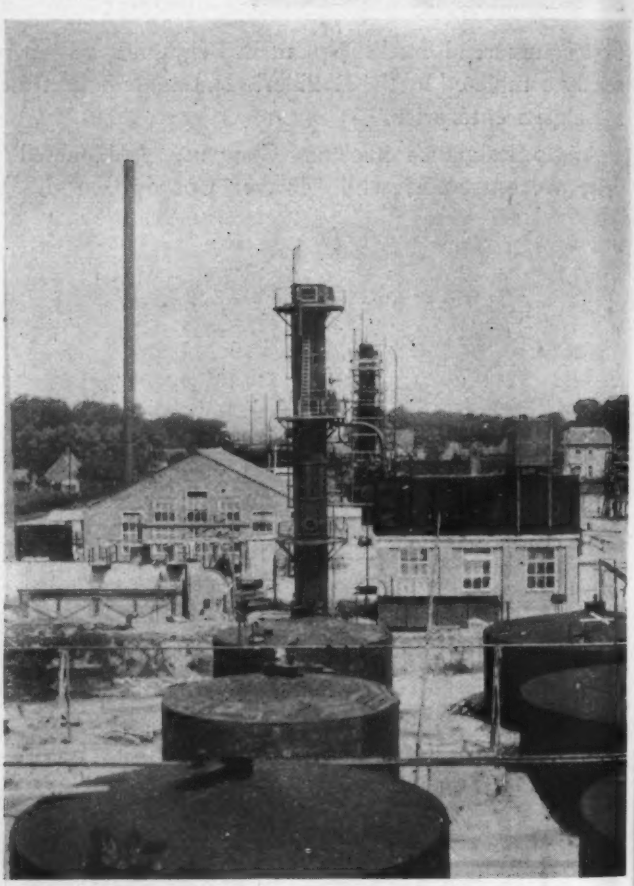


Figure 5—*Rundown Tanks*

the two boilers will furnish enough steam to run the few steam pumps and for other purposes. Room for expansion however is provided and taken care of in the design of the boiler house.

The boilers are provided with fuel oil burners using heavy oil or even the tar from the cracking process.

The feed water comes from a well, dug specially for that purpose, the water from the canal containing too much salts to be used for boiler feed.

HAS RERUN STILL

In the same line with the Jenkins unit and the boiler house firing line, there is located a rerun still of a rather unusual design. As the amount of pressure dis-

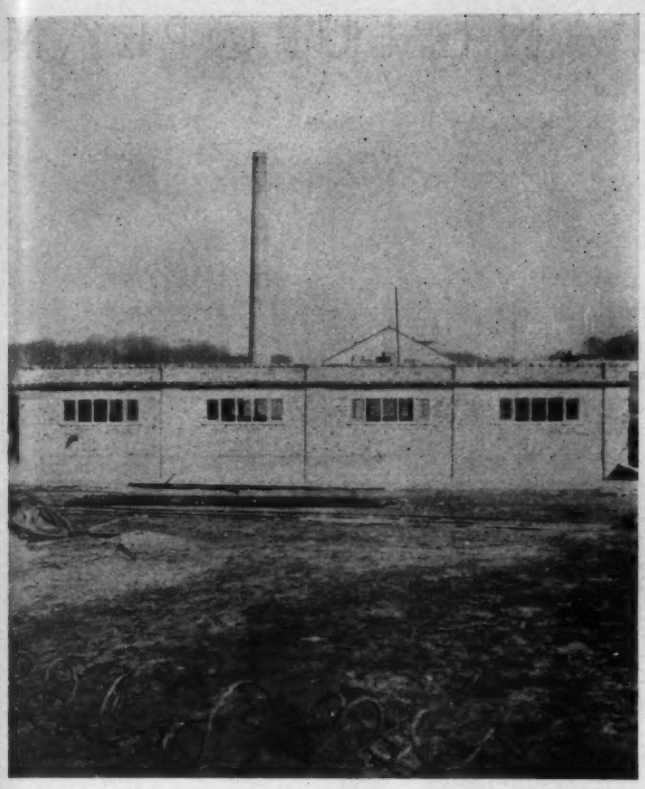


Figure 6—*Transfer Pump House*

tillate available is hardly large enough to warrant the installation of a pipe still the following arrangement was made:

A regular steam boiler (similar to the ones installed in the boiler house) has been provided with the necessary connections and a six by 42-foot bubble tower set up next to it for the purpose of fractionating the gasoline vapors and making the cuts required. The operation is continuous.

Photograph No. 4 shows the general arrangement of this rerun still. Heat is supplied to the still by two fuel oil burners installed in the flue tubes and assisted by live and indirect steam coils placed within the boiler.

A series of run down tanks, some of which are shown on photograph No. 5 have been installed to take care of the intermediate products. The tanks are of the standard 960 barrels type of vapor tight roofs and an earthen dike built around them.

Past the rundown tanks there is the transfer pump house located near the center of the plant. Motor driven centrifugal pumps are used for handling the liquids with the exception of a rotary gear pump to handle the heavy residue from the cracking still. All electric motors and fixtures are of the vapor proof design. Photograph No. 6 shows the type of the building housing the pumps.

HAS BATCH TREATING PLANT

A batch treating plant has been installed in preference to a continuous plant for various reasons, principal of which is the lack of skilled labor to adjust quickly and efficiently the operations of a continuous plant.

There are three agitators: one for acid, one for caustic soda and one for doctor solution and blending purposes. The acid agitator only is lead lined. A series of acid tanks, chemical tanks and blow cases com-

(*Continued on page* 162)

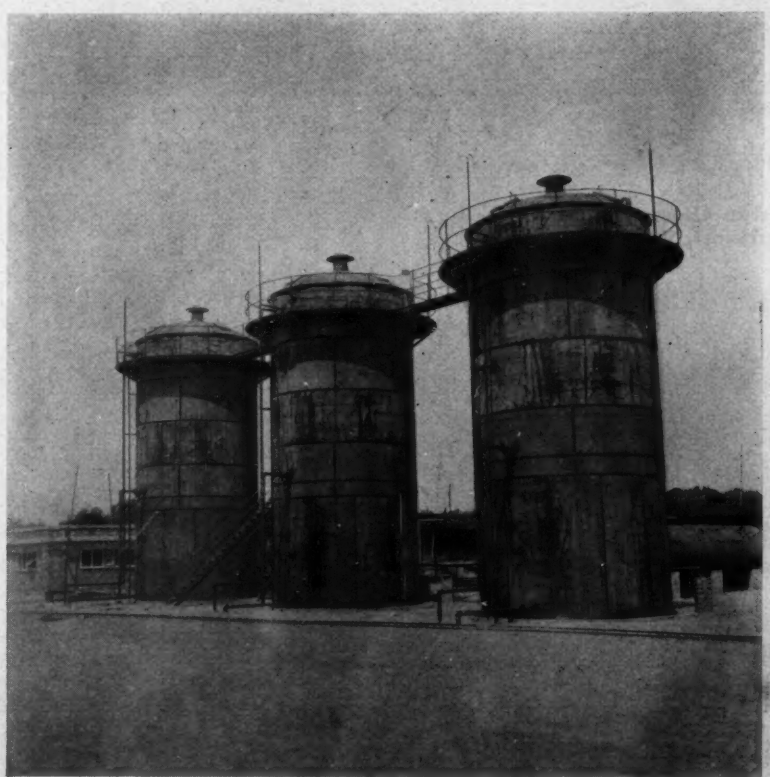
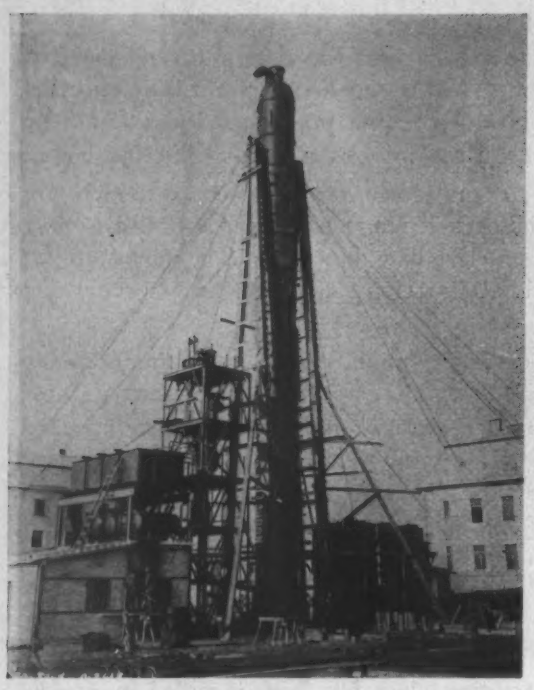
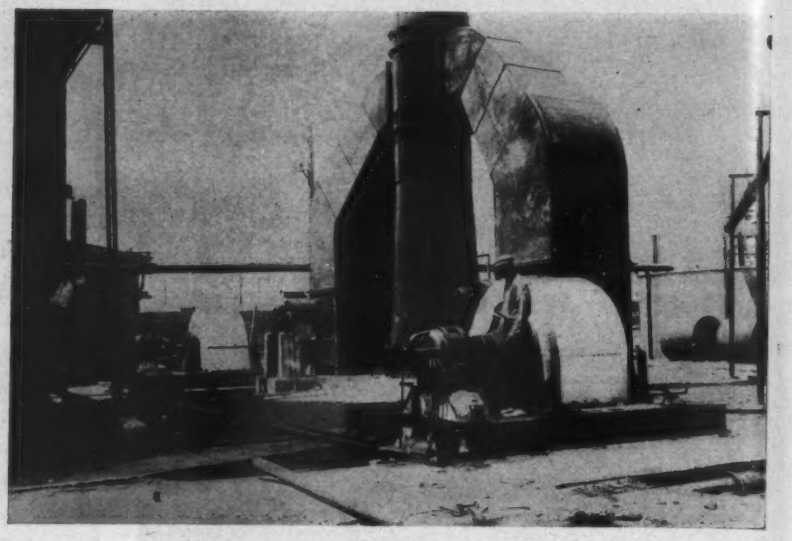


Figure 7—*Treating Plant*

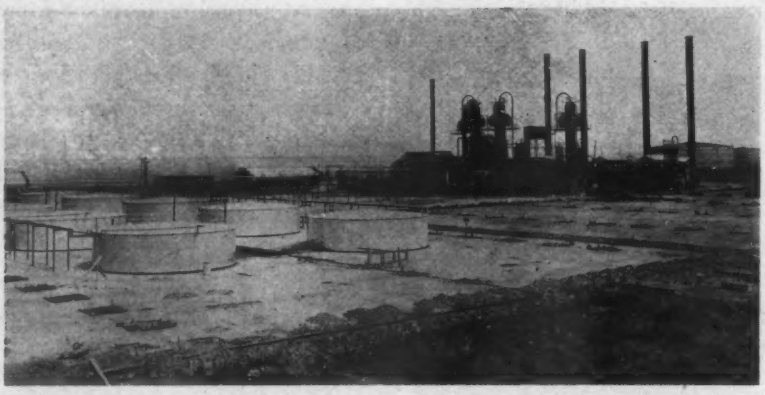
VIEWS OF IMPORTANT EUROPEAN





Modern air-recirculating equipment in conjunction with tube still operation at the refinery of the Asneft State Oil Trust, Baku, Russia.

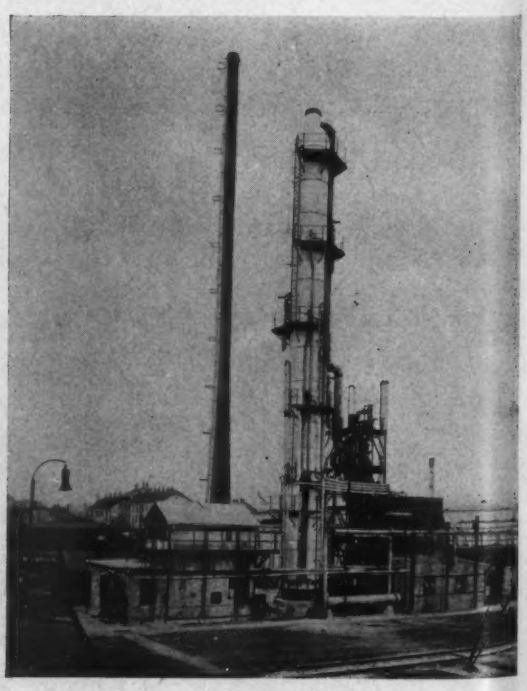
Above — Modern equipment being installed for a Shell unit at Budapest, Hungary.



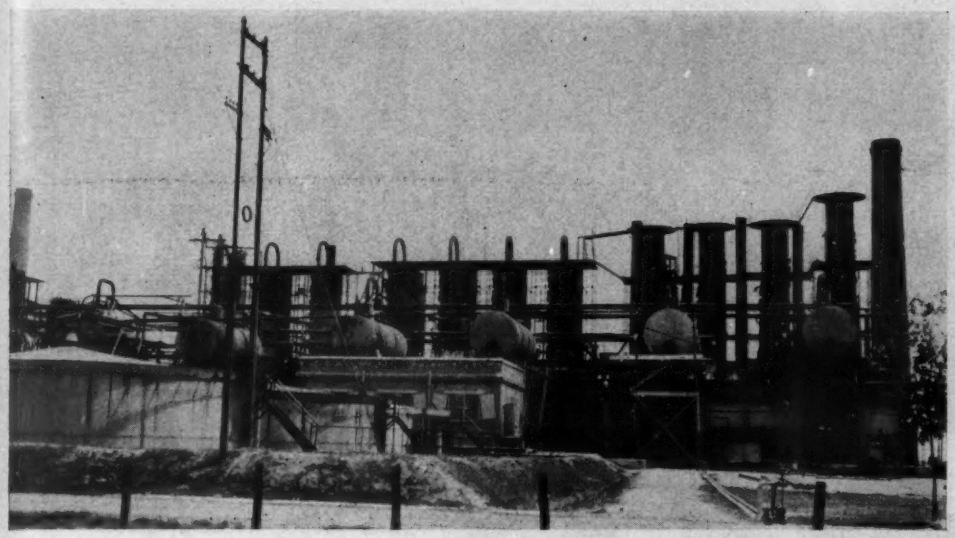
Right—Petroleum Refineries Ltd., Killingholme, England.

Below — Refinery of one of the Shell group at Vienna, Austria.

Below—Pechelbronn Company's refinery, Pechelbronn-Merkwiller, Bas-Rhin, France.

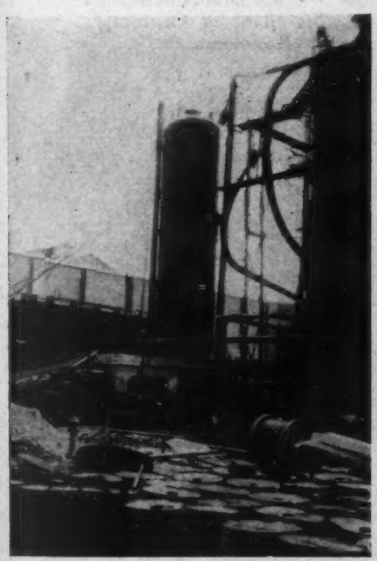


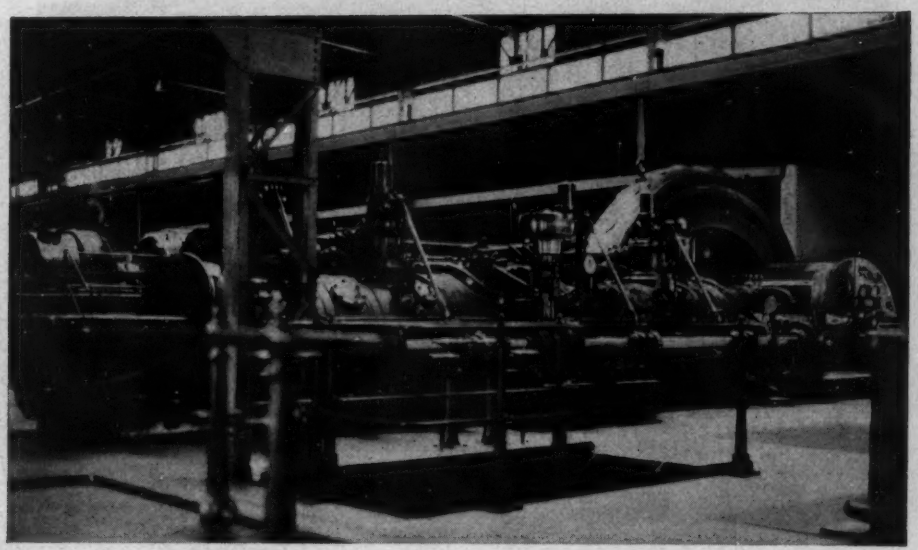
PETROLEUM REFINING ACTIVITIES



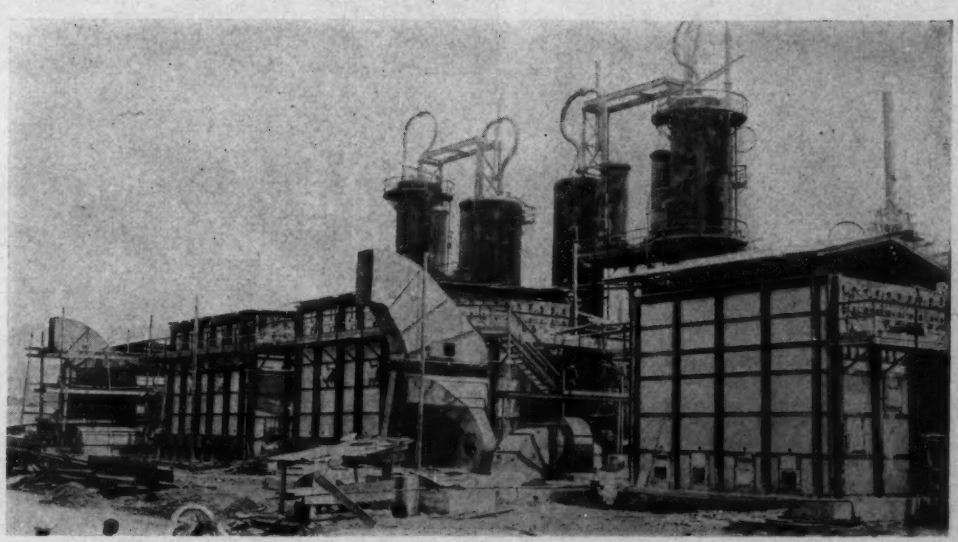
Left—Romana-Americana refinery, Teleajen, Roumania.

Below—Interior of Astra-Romana's electric generating plant, Moreni, Roumania.



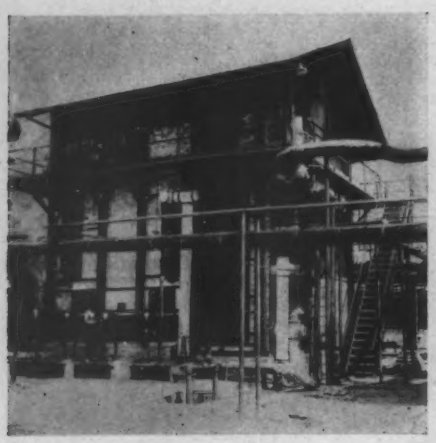


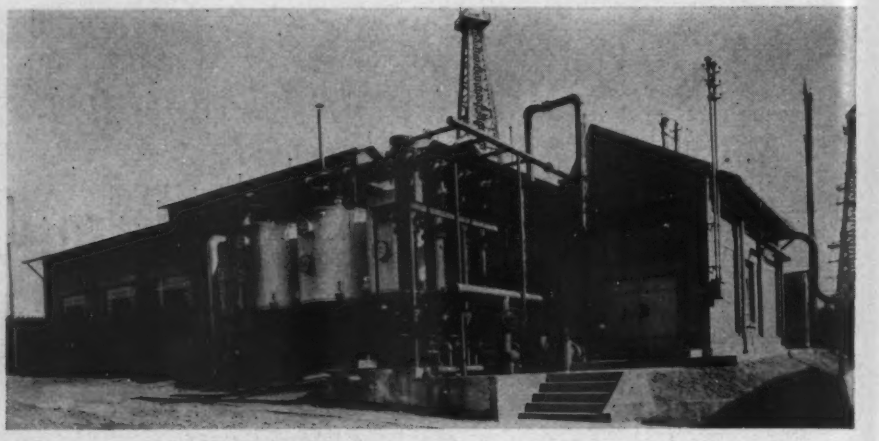
Erecting American made soaking drum at Steaua Romana refinery, Campina, Roumania.



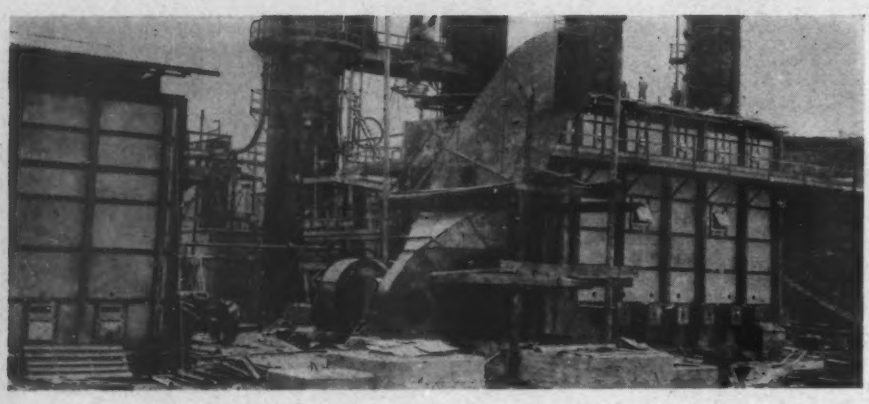
Right—Plant under construction by Grozny Oil Trust, Grozny, U. S. S. R. American equipment is used throughout.

VIEWS OF IMPORTANT EUROPEAN



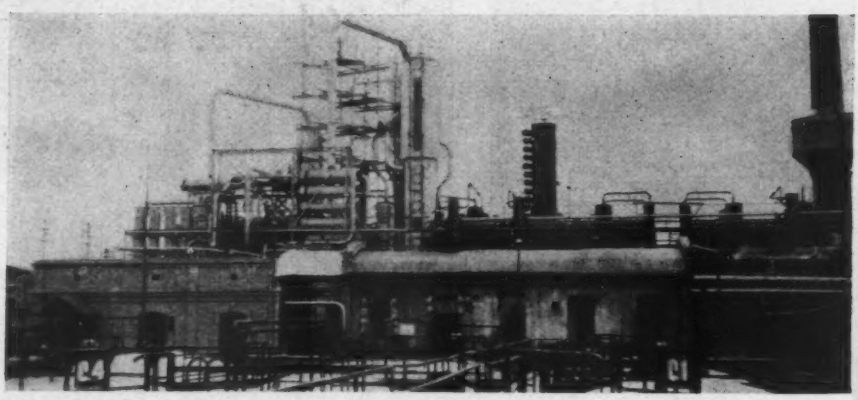


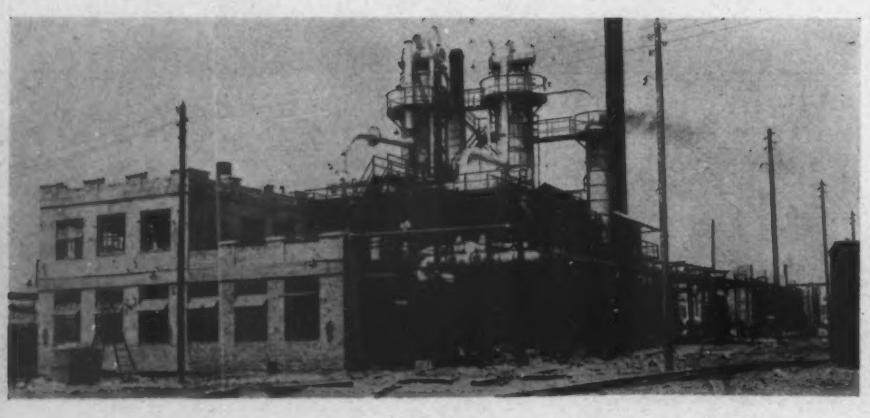
Left Above—Modern 10,000-barrel capacity pipe still, Asneft Oil Trust, Baku, Russia.



Above — Romana-Americana's gasoline plant at Ceptura, Roumania.

Above—Units Nos. 3 and 4, Grozny Oil Trust, Grozny, Russia, as photographed July 8, 1930. American equipment of late design is being employed in all new Russian plants.

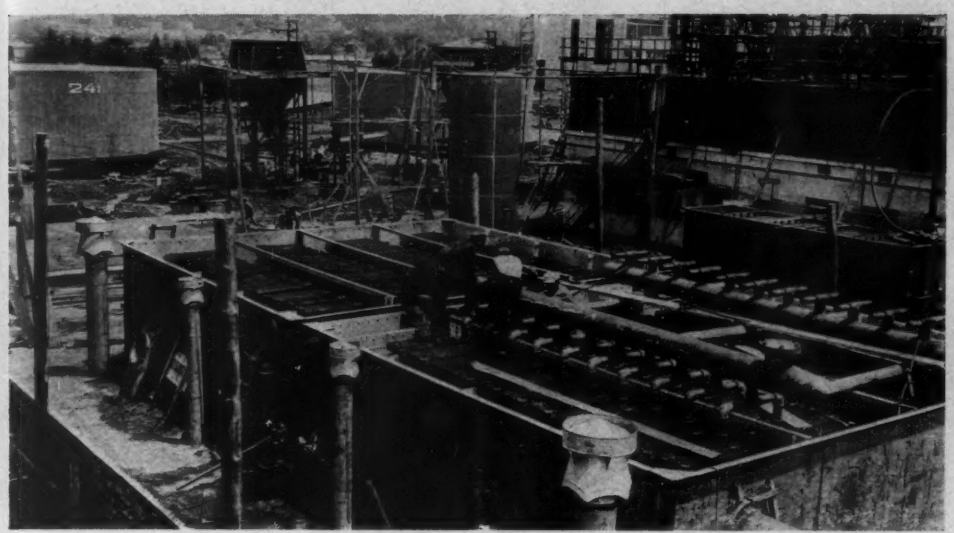




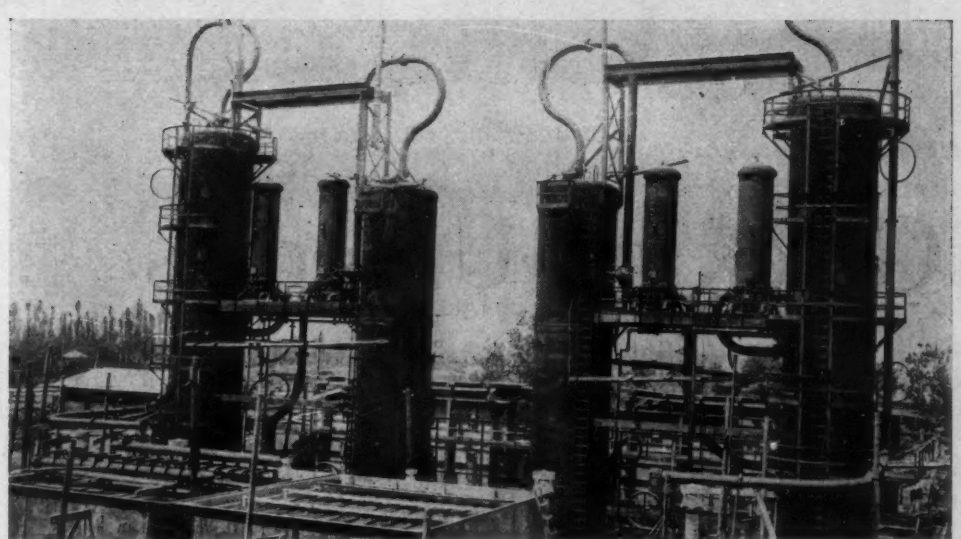
Above—Steaua Romana refinery, Campina, Roumania.

Left—Rear view of tube still unit showing lay-out and construction of pump, control and receiving house. Asneft Oil Trust, Baku, Russia.

PETROLEUM REFINING ACTIVITIES

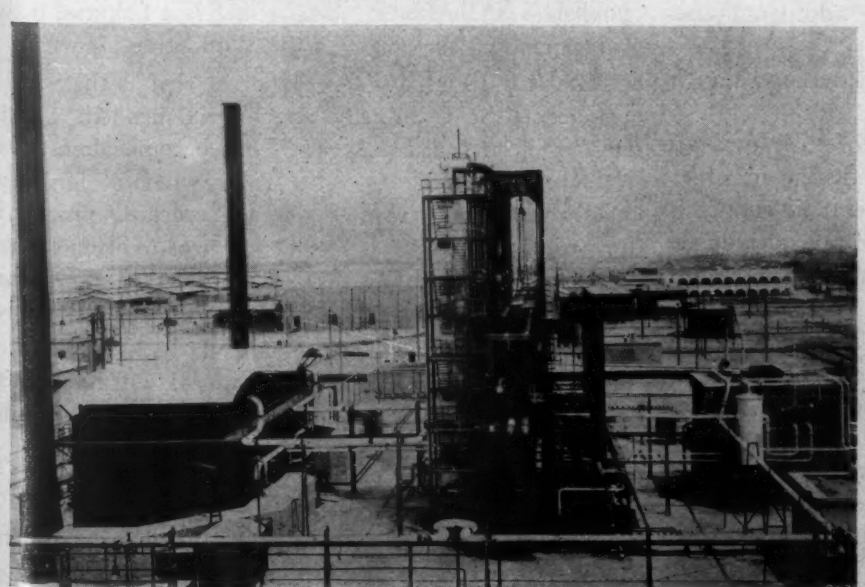


Left—Fabrication of condenser sections in the large condenser boxes as used by the Grozny Oil Trust, Grozny, Russia.

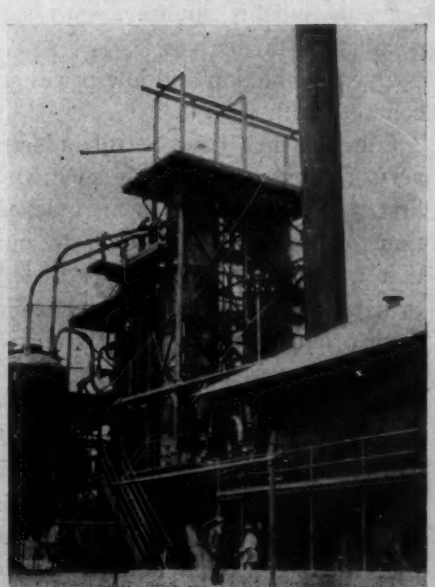


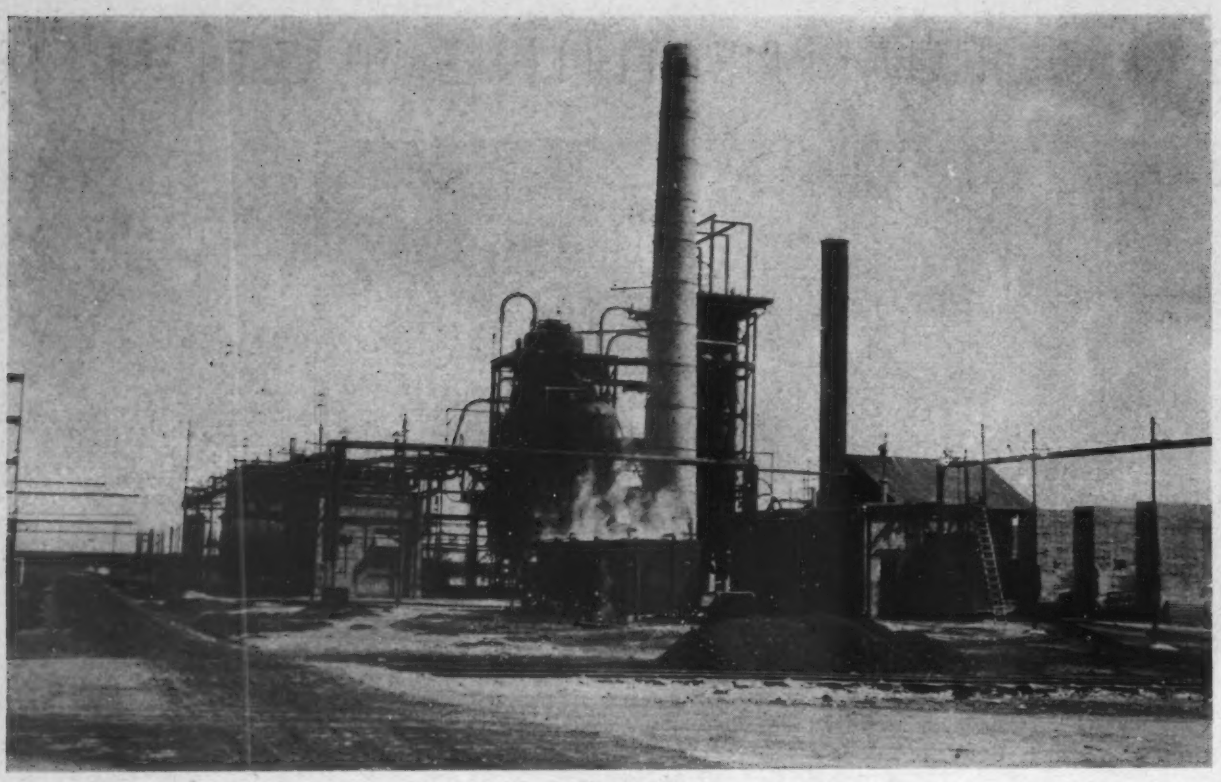
Right—Modern scientific fractionating equipment being installed at the refinery of the Grozny Oil Trust, Grozny, Russia.

Below—Modern distillation equipment at the refinery of Anglo Persian Oil Company, Abadan, Persian Gulf region.



Below—Romana-Americana's cracking plant, Teleajen, Roumania.





Romana-Americana Refinery, Teleajen, Rumania

Cracking Urged as Answer to Europe's Oil Problems

By PAUL TRUESDELL
Universal Oil Products Company

THE nations of Europe, generally, are facing similar oil problems as those that are worrying us in this country, with some additional ones peculiar to themselves.

Over-production and low prices some nations have in common with us.

Others which have no oil industry of their own are very anxious to establish such an industry in order, first, to give themselves an independent oil supply in time of emergency; second, to build up an industry that will give employment to their citizens; and third, to keep the money spent for gasoline and other petroleum products in their own countries instead of letting it travel across the sea.

Study of European publications shows that Europe is more and more turning toward the cracking process as a solution for both types of problem.

Not only are private business interests in Europe giving more and more thought to the possibilities which the cracking process holds for them but governments as well are showing a great deal of interest.

One of the latest significant utterances on the subject of cracking in Europe is found in the ARGUS, published in Bucharest. This paper is a financial daily, corresponding somewhat to the Wall Street Journal.

The July 10 issue of this paper carried as the leading article on the front page an editorial headed "Cracking." This word, by the way, has become almost universal in the languages of the world, which is significant of the importance with which the cracking process is regarded everywhere. The article was written by the editor-in-chief of the paper and consisted of an analysis of the petroleum problems in Rumania, suggesting government-aided cracking as a remedy.

A few quotations from the editorial will have a familiar ring to American oil men. For instance, the writer says:

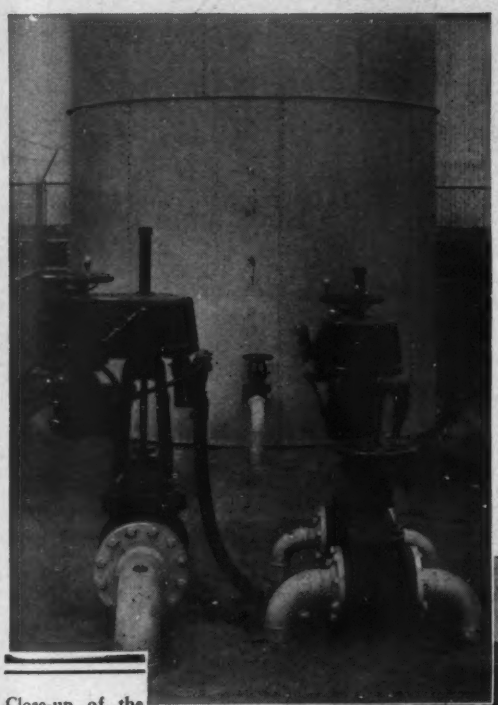
TOO MUCH FUEL OIL

"The illness which is affecting at present the oil industry is excessive production of paraffin pacura (fuel

(*Continued on page* 174)

The Automatic Pump Station at the Tulsa Exposition, erected by the Scientific and Technical Committee. Chapman Motor-operated Valves in the foreground.

The automatic pump station at the Tulsa Exposition uses CHAPMAN VALVES *equipped with* CHAPMAN MOTOR UNITS



Close-up of the Chapman Valves with Chapman Motor Units, at the Tulsa Exposition. These valves are operated solely by oil level and oil pressure.

One of the dreams of the oil engineer is coming true. Pump stations on gathering lines or boosting stations on trunk pipe lines can now be installed for automatic operation throughout, with motor operated equipment stopped and started by oil level and oil pressure.

This equipment *must* be troubleproof. That is why, in the demonstration station at the Tulsa Exposition (illustrated above) Chapman Motor Units on Chapman Valves were depended upon to produce a result that has set the entire industry thinking. These motor units, developed and standardized by Chapman, have shown their dependability in hundreds of remote control installations in the largest plants. They are perfectly adapted to this new oil field development.

Control Panel for valves shown above. Signal lights indicate at a glance the position of the gate in each valve.

Write us for details.

THE CHAPMAN VALVE MANUFACTURING CO.

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Chapman Valves for Oil Service Carried in Stock:

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THE ANCIENT ORDER

Once it was necessary that the design of pressure vessels fit the available means of making them.

Now it is the requirements of the intended *use* that count. The SMITHWelding process can be applied to any design.

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General Offices: Milwaukee, Wisconsin
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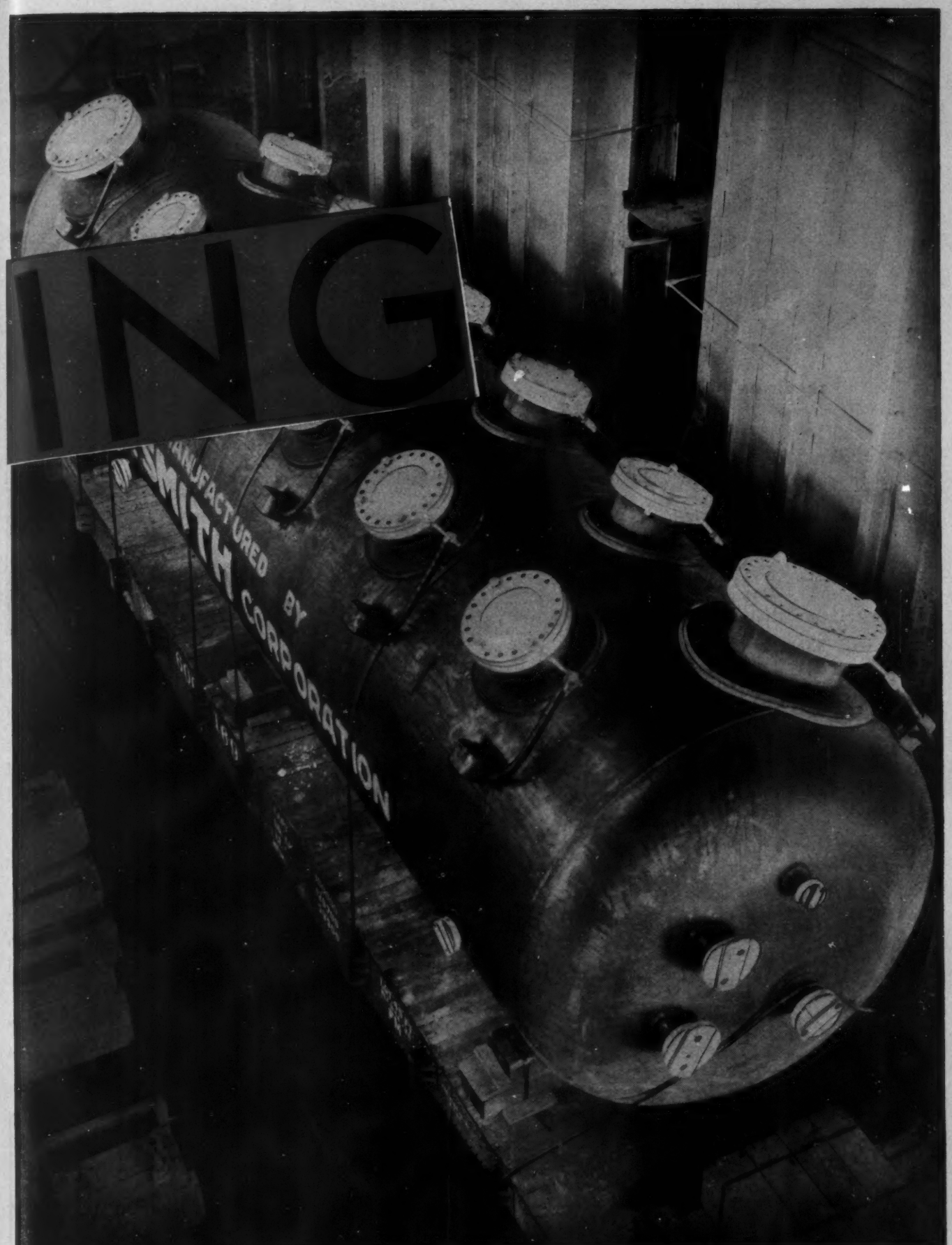


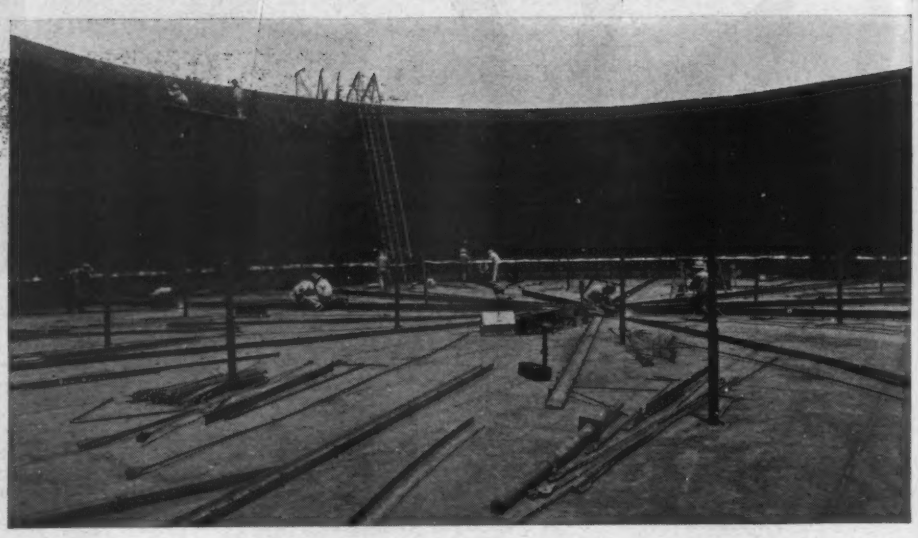
CRACKING STILLS

TRADITION

PROGRESS

"MY observation has been that most of the tank builders are using the Lincoln 'Stable-Arc' welder on the roofs and bottoms of tanks.

Don't tell me that so many men will share a common preference."



"True, but this is no *common* preference, Pop.

An automatic idling device that effects a 25% saving in fuel consumption is not common to all welders — it's an exclusive Lincoln development.

An all welded steel frame and welded steel canopy with welded steel removable side and end panels for protection against the elements and meddlers is not common welder construction.

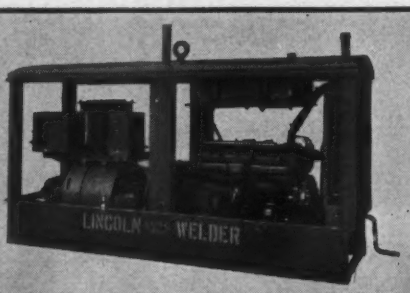
The stability of the Lincoln arc is not common to welders—it is UNUSUAL and gives operators a chance to produce faster and better welding.

And that's why operators prefer the Lincoln 'Stable-Arc'—why it has been used on the *majority* of arc-welded pipe lines — and why the Lincoln machine has this wide appeal to the crude as well as to the refined (speaking in oil terms)."

THE LINCOLN ELECTRIC COMPANY
Department No. 34-10 Cleveland, Ohio
World's Largest Manufacturers of Arc Welding Equipment

W-162

LINCOLN
"Stable-Arc"
WELDER



Lincoln "Stable-Arc" welders gasoline engine driven type are built in 200, 300, 400 and 600 ampere sizes.

Chemists Discuss Synthesis and Refining of Gasoline

SYNTHETIC production of motor fuels by cracking, hydrogenation, and other catalytic processes, condensation and absorption and fractionation of hydrocarbons, detonation and the study of gum formation occupied important places on the program of the petroleum division of the American Chemical Society at its eightieth meeting in Cincinnati, September 8 to 12.

Much interest was evidenced in the discussion of the hydrogenation process by R. T. Haslam and R. P. Russell of Standard Oil Development Company. Photographs of the plant now in operation at Bayway were shown and the history of process development from the work of Bergius to the present time was presented. Four applications were presented by the authors, including hydrogenation of heavy residues of petroleum or coal for the production of motor fuel, the treatment of lubricating fractions of Mid-Continent crude to produce by the process of saturation, lubricants closely resembling the Pennsylvania lubricants, the treatment of low grade kerosene distillates to produce a high quality burning oil, and the treatment of cracked distillates. Reduction in sulfur and gum forming constituents, decrease in knock tendency, and improvement in color were pointed out as definite advantages of this type of processing.

The authors state that approximately 80 per cent of the sulfur present in materials undergoing treatment (hydrogenation) appears as hydrogen sulphide in the reaction gases, which effects an ultimate marked lowering of sulfur in the resultant products. This sulfur reduction is practically always accompanied by a similar decrease in gum forming constituents in the distillates and this eliminates much of the large volumetric losses incurred through the employment of acid treating to effect the removal of these substances.

W. J. Podbielniak, recognized authority among petroleum technologists for his important work and apparatus in fractionation of low boiling hydrocarbons, presented a discussion of fractionation and details of a new column he has developed which increases the efficiency in fractionation of natural gas and gasoline hydrocarbons.

GUM FORMATION

The discussion of gum formation by D. T. Flood and J. W. Hladky and Graham Edgar of Ethyl Gasoline Corporation added much to previous work on this subject. In conclusion the paper states: "The substances chiefly responsible for gum formation in gasolines are: aliphatic diolefins, cyclic diolefins, and mono or diolefins attached to a benzine ring. High concentrations of certain monolefins might be occasionally involved. Except perhaps in special cases gum formation is always associated with oxidation. Stabilization of an unstable gasoline may be effected by refinery treatment removing these classes of hydrocarbons or by the use of gum inhibitors.

"Gum inhibitors seem merely to increase the length of time before an unstable gasoline begins to break down. Since commercial gasoline is frequently stored for quite considerable lengths of time (a year or more) it would appear essential that inhibitors should be added in sufficient quantity to stabilize the gasoline for the periods of time well above the expected normal time of storage, if eventual gum formation is to be avoided.

"The copper dish evaporation test is unreliable as indicating stability. It seems probable that some type of oxidation test may give results correlating with average storage conditions. It would appear that a relation may be found between length of induction period and time of stability in storage. Gasolines may, however, be expected to show marked differences in the rate at which gum is formed after it once begins to be formed, some gasolines forming it more rapidly than others. Any complete oxidation test must involve both the determination of the induction period and the rate of gum formation after the induction period is over."

J. C. Genniesse and R. Rueter of Atlantic Refining Company, presented slides of apparatus in which they experimented to determine influences of time and temperature upon the cracking rate and nature of cracked products from a Mid-Continent gas oil. At the average interval of 17°C. they found that this increase in temperature doubles the rate of cracking with the interval being smaller before 480°C. and a little greater above that temperature.

The principle effect of temperature is interpreted to be to change the rate of reaction in formation of coke, gas and gasoline; a shorter exposure at elevated temperature securing essentially the same results as longer time exposure at lower temperature. A point definitely determined is that in recycling the residue of a previous cycle the more it is recycled the greater is the refractoriness of the stock and the lower the yields of gasoline; and only higher temperatures and longer exposures can produce similar results to earlier cycles and then at the expense of greater losses.

(*Continued on page* 160)

Polish Refining Industry Advances

POLISH refineries in 1929 processed a total of 656,131 tons of crude produced in Poland through 32 operating plants. The full range of products as derived from these operations including gasoline, kerosene, fuel oils, lubricating oils, paraffin, greases and specialties. About half of these refineries are of average capacity, ranging from 30,000 tons to 300,000 tons annual rated charging capacity.

The refining industry was more or less demoralized during the great war in Poland, with the result that since 1919 it has been necessary to rebuild seven of the larger refineries, and to erect three new plants, which new construction, however, has given the industry in that country several modern refining installations. Many of the smaller plants reported operating employ obsolete processing methods and equipment.

Cracking equipment is employed in this country in seven of the 32 operating plants and these seven plants have a total of 560,000 tons annual rated charging capacity or about 42 per cent of the rated operating capacity of the country. There has been some expansion of cracking facilities in Poland during the past year or two as Bureau of Foreign and Domestic Commerce, Trade Information Circular No. 623, issued in 1929 and covering 1927-28 operations, reports but three Polish refineries equipped with cracking units.

Total rated capacity of all 49 refineries in this country is 1,468,000 tons (9,248,400 barrels*) annually. Of this number 17 refineries were inoperative during 1929, with a total rated capacity of 162,000 tons (1,020,600 barrels), which is approximately 11 per cent of the total.

Included in the shut-down refineries there is one with a rated capacity of 60,000 tons, one rated at 12,000 and 15 refineries with a rating of 6000 tons each annually. The total capacity of these 17 shut-down plants is 162,000 tons annually, and the total rated capacity of all 49 plants in Poland is 1,468,000 tons, the 32 operating plants having a combined rated capacity of 1,306,000 tons annually. Of this capacity only 656,131 tons were used last year, which means that the Polish refineries processed 4,133,625 barrels of crude from the oil fields of that country during the period. This indicates that the industry ran crude at about 45 per cent of the total rated capacity of the 49 refineries, and at 50.2 per cent of the rated capacity of the 32 operating plants.

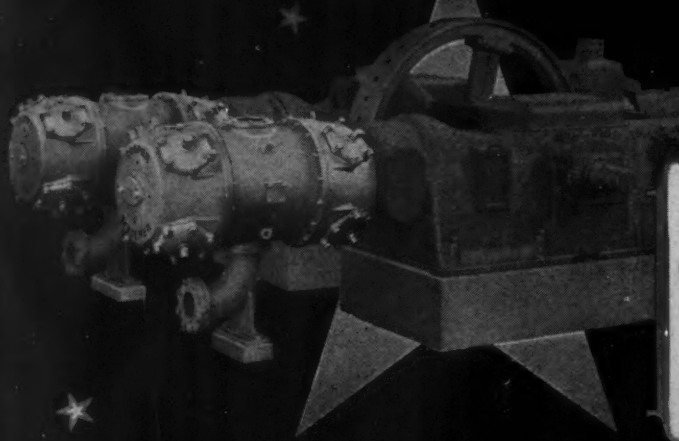
The comparative importance of the Polish refineries

(*Continued on page* 170)

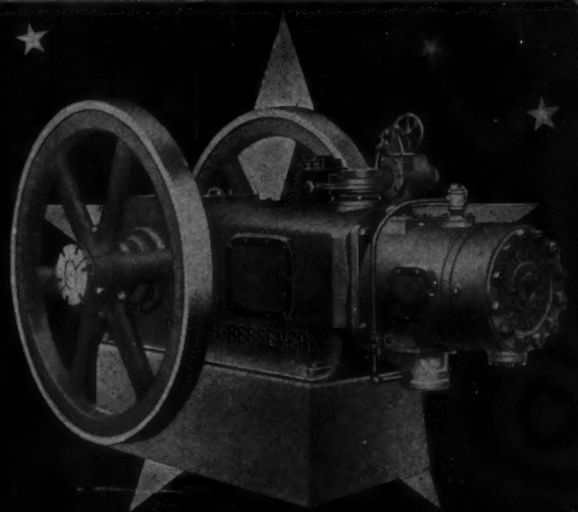
(* The factor used for conversion of tons to barrels is 6.296, and for these figures the factor 6.3 was used. Authority—Kansas City Testing Laboratory, Handbook of Petroleum, Asphalt and Natural Gas, Bulletin No. 15, page 99.)

Gasoline extraction plant operated by Societe "Limanowa," Boryslaw Field, Poland

NEW STARS AT THE EXPOSITION



A NEW COMPRESSOR CYLINDER The following improvements are the result of our own and the experience of other builders of compressor cylinders: (1) Valve-in-head construction, (2) Clearance reduced to a minimum, (3) Higher efficiency, (4) Better water cooling, (5) Special materials giving extra strength.

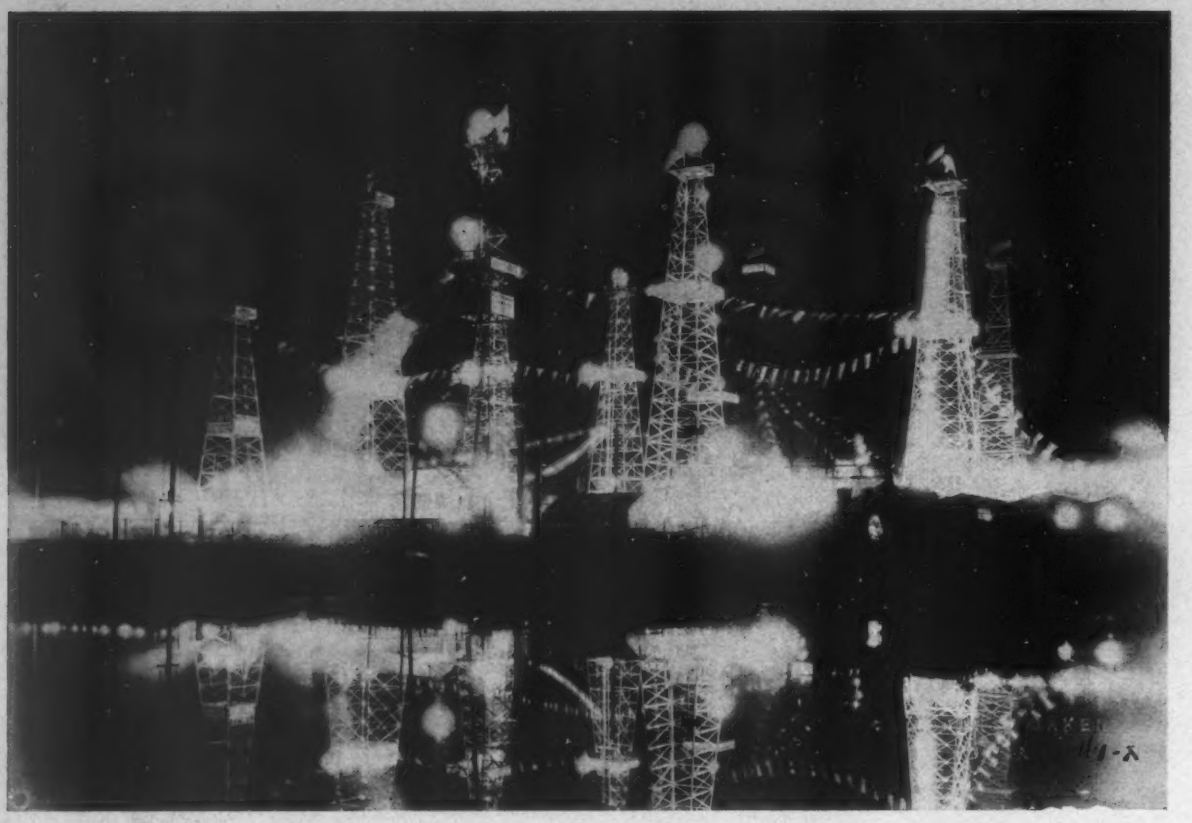


A NEW TYPE VERTICAL The following points are evidence of the sound engineering behind this compact, clean-cut, convertible engine (75 to 200 B. H. P.): (1) Main frame of ample strength, (2) Die-forged crank shaft, (3) Drop forged connecting rod, (4) Separate mixing valve for each cylinder, (5) Silent roller chain driven cam shaft, which is carried on roller bearings.

A NEW TYPE TGA Careful field study of pumping and drilling engines is responsible for the following features, found in Type GA engines (25 to 50 B. H. P.): (1) Timken main roller bearings, (2) Die forged crank shaft, (3) Sturdy main frame, (4) Improved air valve, (5) Special materials where needed.

The Cooper-Bessemer Corporation, Mt. Vernon, Ohio, Grove City, Pa.

COOPER-BESSEMER



The Exposition

THROUGH the International Petroleum Exposition and Congress, the petroleum industry has an opportunity to take a look at itself. The exposition may be likened to an expensive mirror, set up once a year for reflection. It is a mirror which must be changed frequently since progress makes one event obsolete within a brief period. It is only the reflective surface however, which must be changed. The frame, represented in the exposition plant remains for holding the new surface each time. Even the frame has to be altered for the mirror grows with each year and its holder must be tailored to fit the reflector it must hold.

The exposition plant for the 1930 oil show presents a growth which required the expenditure of more than $100,000 to bring it to a size sufficient to hold the exhibits on display. Growth has been the history of each of the recent expositions; and all indications are that changes in plant will continue each year, although the expenditures of 1930 may not be matched again, as two new buildings were added previous to the opening of the event.

Displays of equipment are not exceptional to industry. But there are few industries which are willing to devote 10 days to the privilege of looking into their mirrors of progress. That much time is required and freely given for the International Petroleum Exposition and Congress.

Equipment is the foundation of the exposition. It started with little other than equipment and the amount of that was trival compared with the amount placed on display today.

On this score the manufacturing division of the petroleum industry deserves unstinted praise. Without equipment the exposition never could have been started. The manufacturer defrays the expense of staging the exposition while the buying side of the petroleum industry pays in lesser degree for the priviledge of looking at itself.

Perhaps the outstanding development in exposition affairs is the trend toward scientific and technical meetings as a part of the exposition. In the early years of the exposition, efforts were made to conduct a series of meetings and congresses. These

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(PATENTS PENDING)

"The Pigment Expands"

Apply heavy film coat to threads, flanges, gaskets or metallic surfaces to be sealed, with ordinary paint brush or dauber. Put joints together in regular way. They will be leak proof.

The Principal Pigment In Q-SEAL

EXPANDS—and joints that are defective, such as threads cut with dull tools, warps in flanges, or broken or burned places in gaskets, can be permanently and effectively sealed with Q-Seal, due to its large expansion when subjected to heat. This expansion fills all imperfections and the expanded material is strong enough to hold regardless of temperatures and pressures.

Leak-proof Gasket Joints in Boiler Hand-holes or Manholes can be made with Q-SEAL

Due to its expansive properties, Q-Seal is an ideal compound for sealing gasket joints. Paint gaskets on both sides, or dip them in Q-Seal, and apply them in the regular way.

Shipped in 1 and 5 lb. Cans
10, 30 and 60 lb. Steel Containers

Seal Joints in Lines Carrying Oils, Gasoline, Acids and Chemicals with Q-SEAL

The proper sealing of joints carrying commodities is very important. Q-Seal is impervious to oils, gasoline, chemicals, acids, and in fact, anything but water. Water is the only solvent, but it is being used successfully in cold water joints.

Make Joints in Automobile, Truck, Aeroplane, Diesel or Other Internal Combustion Engines leak-proof with Q-SEAL

Due to the fact that Q-Seal is impervious to oils and gasoline, and that it expands, it is ideal for sealing such joints as cylinder head, manifold, differential and transmission housing, and oil pan gaskets on automobiles, busses and trucks; and it is good for sealing all joints in internal combustion engines.

Get More Surface Coverage at Less Cost per Joint with Q-SEAL

From a standpoint of surface coverage, or cost per joint, Q-Seal is, as far as we know, the most economical compound on the market today. One pound of it will fabricate more joints than four pounds of white or red lead. It does not dry brittle like litharge and glycerine, does not gum and stick like shellac, and does not shrink like graphite and oil, or other compounds which use oil as a vehicle or mixing agent.

Break Joints Easily that have been Fabricated with Q-SEAL

Due to the fact that all pigments used in compounding of Q-Seal are natural lubricants, joints that have been fabricated with it can be broken easily and clean, regardless of age or conditions subjected to.

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failed to progress with the equipment phase of the exposition and were dropped on the basis on which they were started.

But the men of scientific training took up where another effort had failed. While all these sessions are not held within the grounds of the International Petroleum Exposition and Congress, they do select Tulsa and the exposition period as an opportunity for meetings of serious study and discussion. From the activities of the American Petroleum Institute down through the different scientific bodies, Tulsa has become a hot bed of meetings for the exposition period.

This development is logical. Scientific progress marches side by side with mechanical development. The scientist demands and the manufacturer provides. That process may be reversed at times but scientific needs and mechanical provision are never far removed in the petroleum industry.

Although the next meeting of the International Petroleum Exposition and Congress will not be held until May of 1932, it is to be hoped that the intervening period will be used to further the trend of scientific discussions and meetings until that phase of the exposition period comes to be looked upon as sufficient in itself for holding the event.

That part of the petroleum industry known as management deserves praise for its support of the exposition. The executive staffs of all classes and sizes of oil companies have come to look upon the exposition as a proper place for sending men of studious turn. Men are urged to take advantage of what the exposition has to offer.

It is significant this year the teams competing in the First Aid Meet are coming from Pennsylvania, Illinois and Ohio. These teams in the past have been from within the Mid-Continent area. The safety program is but a small part of the whole exposition but it has enlarged its influence by several hundred miles.

Likewise the entire petroleum industry is sending more men and traveling more miles just to have a look at itself in this mirror of progress.

TRACYFIER AND STEEL GRATING

The Tracyfier on display by Blaw-Knox Company consists essentially of a rectangular steel box, located in the steam space of the boiler drum immediately below, and connected to the steam nozzle. It is closed on bottom, top, and ends, but has for its two sides a number of rows of gutter-shaped baffles, very carefully staggered. All steam before leaving the boiler must pass through the several rows of baffles which cut it into hundreds of ribbons. This process of exposing steam to metal contact is an important principle in steam purification. Slow velocity in passing through the baffles does not allow the steam to pick up the moisture. Other principle features of the Tracyfier are: centrifugal separation, gravity separation, and expansion separation.

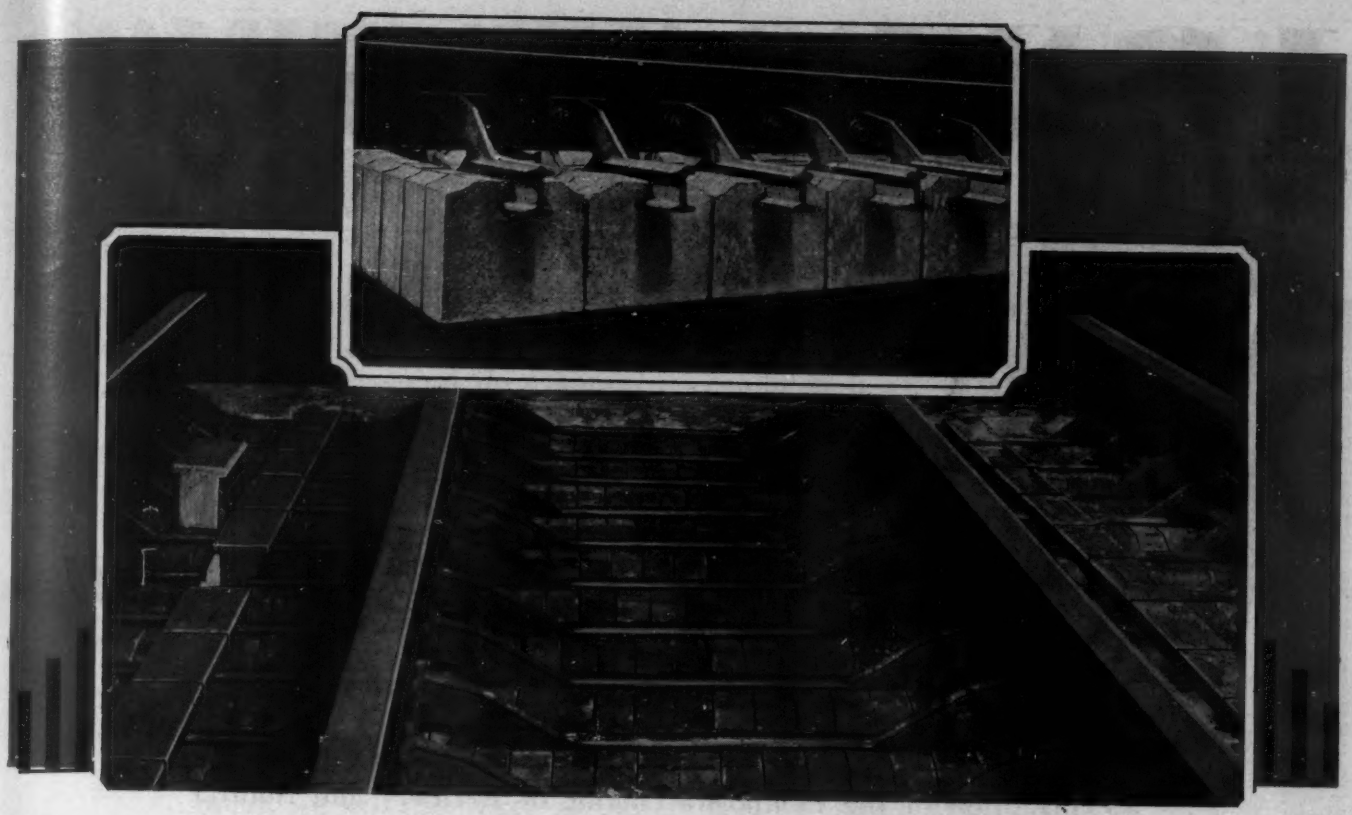
Steel grating being shown is a simple structure, electro-forged for strength and permanence, marked by an entire absence of loose parts since there are no bolts, slots, rivets, friction fits, wedge fits or trick locking devices in the construction of this grating.

Blaw-Knox Tracyfier

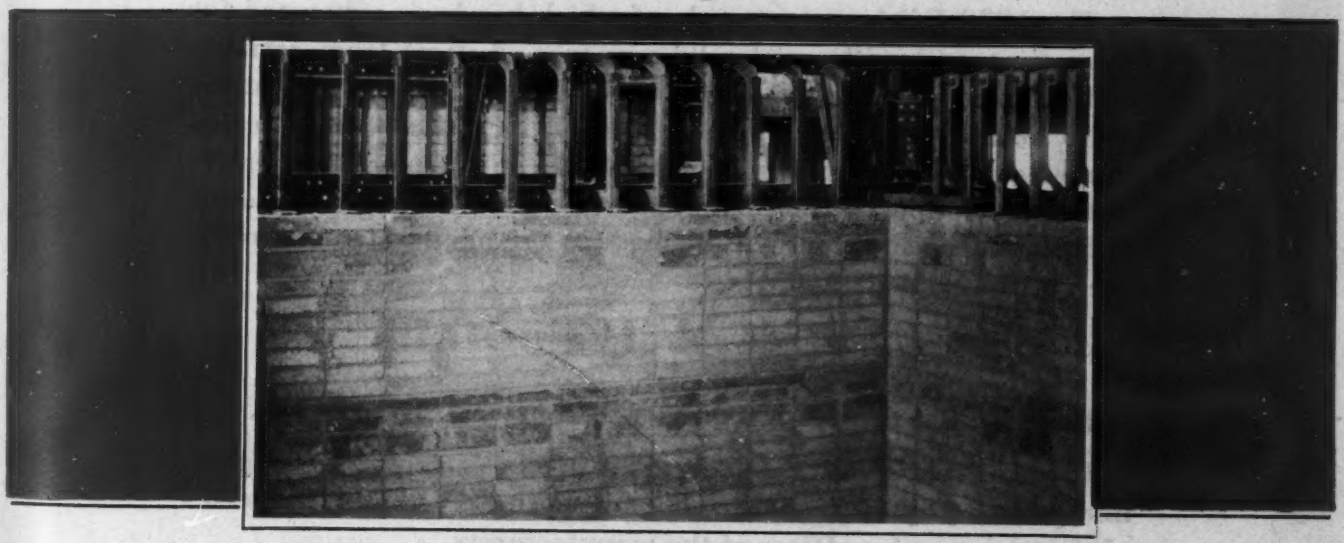
MOTOR VALVE

The Neilan Company is exhibiting the new Neilan ball bearing, rotary stem motor valve. Friction is eliminated in this valve through the widespread application of ball bearings. Nirosta KA2 stainless steel ball bearings, valve stem and linkage are used to prevent corrosion in the valve body where corrosive fluids are generally present. This new motor valve is made in chrome-nickel cast steel for high temperatures and pressures, and is made for use with instrument type temperature controllers, flow controllers and liquid level controllers.

Neilan Ball Bearing Rotary Stem Motor Valve



Laclede-Christy Flat Arches



L-C Supported Air-Cooled Walls

On oil stills, as well as on boiler furnaces, L-C Walls have the same features as L-C Flat Arches; the same, heavy steelwork, the same bolting of castings, the same positive spacing of tile for expansion, the same air-cooling, the same Laclede-Christy Tiles; and therefore,

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Used by Standard, Gulf, Texas, Shell, Barnsdall, Atlantic, Cities Service, Etc.

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1931 EDITION OF

Order Your FREE Copy Immediately

WE have been at work for some time on the 1931 Edition of the Composite Catalog of Refinery and Natural Gasoline Plant Equipment, which will be ready for distribution in January, 1931.

The 1930 Edition, the supply of which has been exhausted for some time, met with a splendid response. Letters from refinery and gasoline plant staff men all over the world advised us that the 1930 Edition was of real value. The 1931 Edition will be an improvement over last year's in that it will contain more descriptive matter on equipment and materials used in refineries and gasoline plants and that additions will be made to the tabular content in the back of the catalog.

What It Will Contain

Here is what the 1931 Edition will contain:

Descriptive matter on hundreds of pieces of refinery and gasoline plant equipment (no display advertising) with the addresses of the various sales offices of the manufacturers.

An index of equipment classified by types (which will show several thousand different listings and with which the addresses of manufacturers can be immediately located).

Gravity correction tables. Volume conversion tables; tables of the properties of saturated steam, ammonia vapor, sulphuric acid and caustic soda

Viscosity of mixtures table and conversion tables for various viscosimeters.

COMPOSITE CATALOG *NOW* APPROACHING

Engineering data on pumps and pumping equipment, compressors, belts, friction in pipes, water measurements, boiler equipment, and general information on combustion.

Conversion factors for quantities, metric and English systems, areas and volumes, and other general engineering information.

The Catalog itself will run several hundred pages in size, will have a high class Fabrikoid type cover on it and will be bound with the same style of binding used in a fine book.

No Charge For It

Under our agreement with the manufacturers who co-operate to make this Composite Catalog of Refinery and Gasoline Plant equipment, we will distribute absolutely free of charge 4000 copies of the 1931 Edition to the following classifications within the refining and natural gasoline manufacturing industry:

Executives in charge of refinery or gasoline plant department,
Purchasing agents,
Refinery superintendents,
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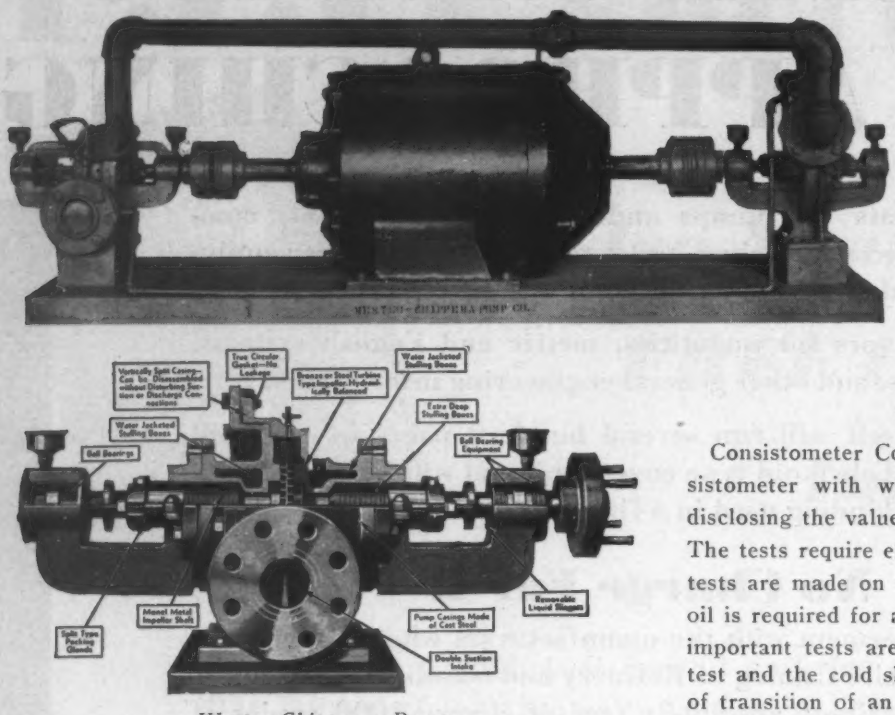
I am with the above company. _____

My position is. _____



Westco-Chippewa Pumps

PUMPS

Westco-Chippewa Pump Company has on exhibition charging pumps, reflux pumps and hot oil pumps. The Westco principle of pumping liquids makes it possible to deliver relatively small capacities against high pressures in a very simplified pump design. The charging pumps offered for stabilizing towers, still charging pumps, etc., are capable of operating against the required pressure of about 300 pounds in single or two-stage. The centrifugal pump type has a constant non-pulsating flow.

Westco reflux pumps may be used on exceedingly high gravity liquids with very satisfactory results since they are built to handle an appreciable amount of vapors along with the liquid without vapor binding.

The Westco hot oil pumps are provided with steel casings and have certain stuffing box designs that make them distinctly advantageous. The high head performance in single stage construction assures the simplified design so highly essential for hot oil pumps.

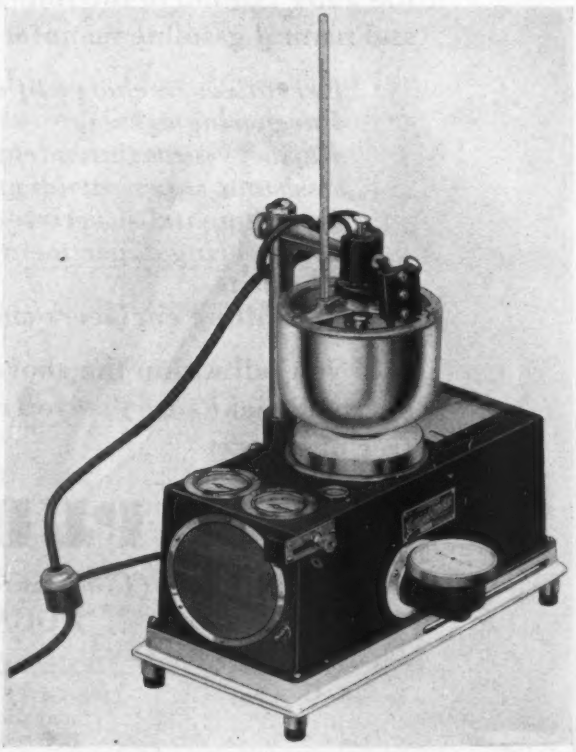
SEAMLESS FITTINGS

Tube-Turns, Inc., Louisville, is exhibiting stock fittings designed exclusively for welding into pipe lines. These are shown in sizes 1 inch through 18 inches in standard iron pipe sizes and 1½ inches through 12 inches in extra heavy iron pipe sizes, both series in 45° elbows, 90° elbows and 180° returns. All are made on a standard radius of one and one-half times the nominal pipe sizes to facilitate designing and are beveled 45° for welding.

These tube turns are made from seamless tubing by a patented process which insures uniform wall thickness at all points and a full pipe size throughout the turn. There is no thickening or buckling of the inside walls, no thinning of the outside wall and no flattening of the cross section. Because they are seamless their strength exceeds lap or butt welded pipe. Other features of these turns are that they have the same co-efficient of expansion and contraction as the pipe line, they cause less pressure drop, can be more easily insulated, can be cut to provide turns or special fittings of any angle and can be installed with easy welds.

CONSISTOMETER

Consistometer Corporation, Chicago, is exhibiting a consistometer with which various mechanical tests are run disclosing the value of refined oils for lubricating purposes. The tests require eight ounces each, and as generally three tests are made on an oil, a total of twenty-four ounces of oil is required for a standard set of tests. The three most important tests are the hot tenacity test, the cold fluidity test and the cold shear test. The hot test shows the point of transition of an oil under a given set of circumstances, as well as its coefficient of friction. The cold fluidity tests disclose the absolute temperature at which any oil becomes to viscous to pump. The cold shear test makes it possible to figure the power required to start an automobile engine with any given oil at any temperature down to 50 degrees below zero.



Consistometer

In addition to these tests the booth contains a historical exhibition of the development of the consistometer through the last seven or eight years.

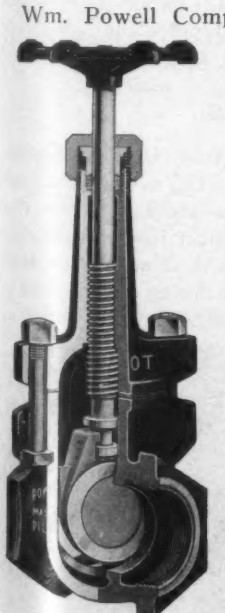
RECORDING THERMOMETERS AND PRESSURE GAUGES

Tycos Recording Gauge

Taylor Instrument Companies, Rochester, N. Y., has on exhibit flush-mounted recording thermometers and pressure gauges. These instruments may be used with one, two or three pens but are most efficient with the larger number. The three records in different colored inks make comparison of records a simple matter. All connections are made on the back of the instrument but the tube system can be removed from the front. As in all Tycos instruments the door is mounted on spring hinges, insuring moisture-and-dust-proof joints. Other features are the micrometer pen adjustment, pen lifter and chart ejector. The pens are of the suspended type with non-corrosive stainless-steel arms. The clock is specially designed with three-point mounting and has a starting device, for convenience. Other instruments being shown include industrial thermometers, regulators for temperature and pressure, vacuum gauges, aneroid and mercurial barometers, pyrometers and valves.

GATE VALVES

Wm. Powell Company, Cincinnati, is showing a complete line of bronze, iron, and steel globe, angle, check, gate and safety valves along with numerous types of oilers, lubricators, grease cups, gauges, and other oil field equipment.



Wm. Powell Valve

One of the feature displays of the company is the new "Master Pilot" gate valve which is built in sizes from ¼-inch to two inches for working pressures up to 150 pounds at 450 degrees F. total temperature, and 225 pounds water, air, oil or gas working pressures at 100 degrees F. Sizes 2½ inches and three inches are designed for 125 pounds working steam pressure at 450 degrees F. or 175 pounds water, air, oil or gas working pressures at 100 degrees F.

"Master Pilot" valves are made with high grade cast iron bodies and bonnets; the stems, packing nuts and discs are made from high grade steam bronze. For handling liquids and gasses destructive to copper alloys the packing nuts and discs can be supplied of iron and the stem of steel. Valve bodies are made with heavy wall thickness and full way openings.

Two heavy lugs are cast on the side of the bodies and are so arranged to slip in and firmly hold head of proper size standard bolts for binding bodies and bonnets together. The bonnets are supplied with full acme threads accurately machined. A large packing chamber is arranged in top of the bonnet allowing plenty of packing with gland follower. Special gaskets are supplied for oil, gas, gasoline, air, steam or water service.

GATE VALVES

The Lunkenheimer Company has on display the various types of the "King-Clip" gate valve. This valve is used in the petroleum industry in the handling of oil, gas, gasoline, air, water and steam.

It is made in three types—inside screw, outside screw, and yoke in sizes from ¼ inch to four inches. Screw end patterns, sizes ¼ inch to two inches are rated at 150 pounds W. S. P.—225 pounds gas-liquid pressure; screw end 2½ inches to four inches, flange end 1½ inches to four inches are rated at 125 pounds. W. S. P.—175 pounds G. L. P. All types are made in both the iron body bronze mounted and all iron patterns.

Lukenheimer "King-Clip" Valve

Internal parts of the valve including the bonnet bushing, are made of bronze; this material offers more resistance to corrosion and wear on all exposed and working parts. The iron casing adds rigidity to the valve. Another feature of interest to the petroleum industry is the deep thread in the body which will accommodate either A. P. I. line pipe or merchant pipe without alteration.

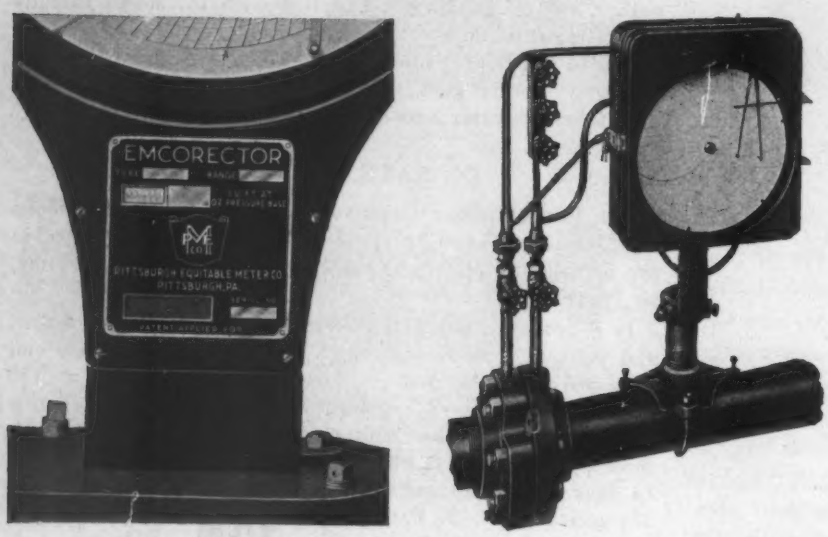
The company is also showing a late addition to its line of products, the "Causul" metal "King-Clip". It is made from the outside screw and yoke patterns and while developed primarily for use in handling caustic and sulphuric acid it has also proved useful in handling other corrosive materials. It is being used also for sludge acid in refineries.

BROWN AUTOMATIC CONTROLS

The Brown Instrument Company, Philadelphia, is displaying the Brown Automatic Controls for governing temperatures, pressures and flows in stills, towers and pump speeds . A new development in this line is the automatic control indicator. Other instruments being shown by this company are: Flow meters, for measuring an dcontrolling gasoline, oil gas, water and steam; liquid level gauges for controlling the level of petroleum products in tanks; pyrometers; resistance thermometers; and pressure and vacuum gauges measuring pressures and vacuums in stills.

ORIFICE METER

The orifice meters being shown by Pittsburgh Equitable Meter Company are entirely water-tight and moisture-proof. The dial differential calibrating and adjusting device make hairline adjustment easy. Micrometer adjustment is used for calibrating static element and zeroing pen. All parts of the differential movement that are subject to corrosion are of stainless steel and the all-welded manifold overcomes small leaks.



Pittsburgh Orifice Meter

EMCORECTOR

The Emcorector automatically corrects the volume for each small unit of flow, every 10 feet or every 100 feet, depending on the size of the meter. This gives a direct reading of the corrected volume with a fair degree of accuracy. The principle of operation of the Emcorector is from a driving shaft which operates a reading index through the connecting arm, the arm being held by a helical spring against the lower edge of a cam which in turn is moved by the pressure in the pressure coil. The cam moves to the left as the pressure in the line increases, permitting the index shaft to move through a greater angle, thereby increasing the increment recorded on the index.

This instrument is made in two models known as the type "W" and the type "C," and can be furnished for use on any high pressure gas meter.

ANTI-SCALE PREPARATION

American Sand Banum Company presents a new way of eliminating scale of any kind from water at any temperature. Scale is eliminated entirely mechanically, not chemically. It treats the solids as they are thrown out of solution. This preparation prevents foaming, priming, and corrosion is not carried over with the steam. It contains none of the usual boiler chemicals or caustic chemicals. Scale is elminated in from six to 12 weeks and formation of new scale is prevented.

HIGH-PRESSURE OIL PUMP

Tuthill Pump Company, Chicago, is displaying the model H high-pressure oil pump which is built in four sizes ranging in capacity from 10 g. p. m. to 40 g. p. m. against pressures up to 1000 pounds per square inch when pumping liquids with good lubricating qualities. A fifth size to furnish 100 g. p. m. for pressures not exceeding 500 pounds per square inch is available upon order.

Special operating features include the ability to drive this model at direct motor speeds up to 1200 r. p. m. and mounting flexibility through special pipe flange for both discharge and intake ports to eliminate extra pipe joints and permit use of the manifold best suited to each installation.

Construction features include interchangeability of all parts, ball and roller bearings carrying all loads, no gaskets under pressure, shafts, and gears of alloy steel, and special hardened steel plates to resist end wear commonly encountered in gear pumps.

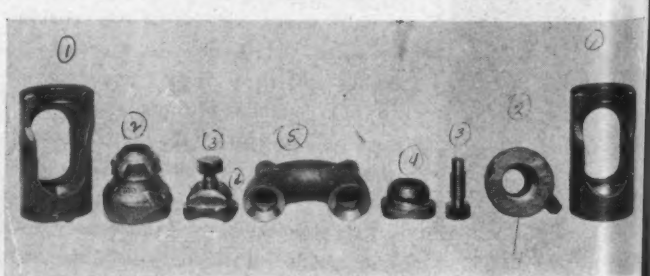
Tuthill High Pressure Pump

WELDING EQUIPMENT

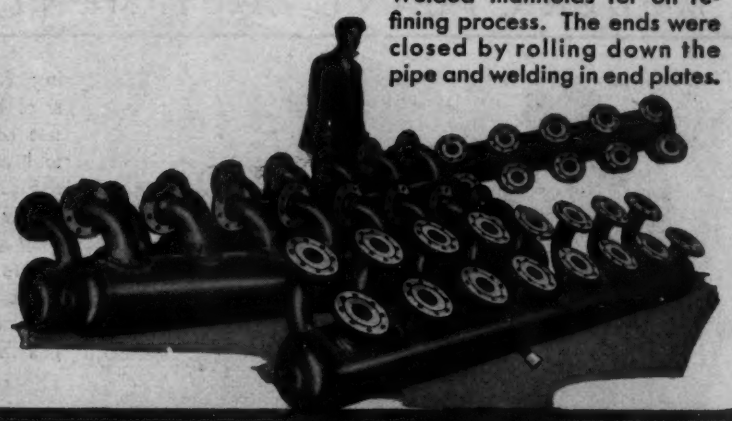
Victor Welding Equipment Company is displaying a complete line of Victor pipe line and refinery welding equipment, together with the latest Victor senior and junior safety regulators. Cutting, welding, brazing equipment and metal cutting with oxygen and liquid petroleum gases is being demonstrated.

RETURN BENDS

Ohio Steel Foundry Company, Springfield, Ohio, is displaying a number of types of return bends. The new return bend being shown for the first time provides for full stream line flow using in the design a true line contact joint obtained by the use of a ball on the tube end pieces, making contact with a tapered surface on the U part of the fitting. That gives a leak-proof joint and eliminates any possibility of difficulty in



PIPING BY MIDWEST FOR ALL PURPOSES



Welded manifolds for oil refining process. The ends were closed by rolling down the pipe and welding in end plates.

A large southern refinery was in a hurry for these bends from 22" O.D. pipe.

Coil for special refining process. Customer's inspector pronounced this—"The best coil job I ever inspected."

REFINERIES, natural gasoline plants and pipe lines . . . a constantly increasing number depend upon Midwest whenever they require fabricated piping. There are good reasons for this condition; several of these reasons are evident from the photographs. » » It will be to your advantage to get in touch with the nearest Midwest office when you need fabricated piping.

MIDWEST PIPING & SUPPLY COMPANY, INC.

MAIN OFFICE: 1450 So. Second St., St. Louis

Plants:—ST. LOUIS, LOS ANGELES, PASSAIC & HOUSTON

Offices:

NEW YORK (Ballwood Div.) 30 Church St.

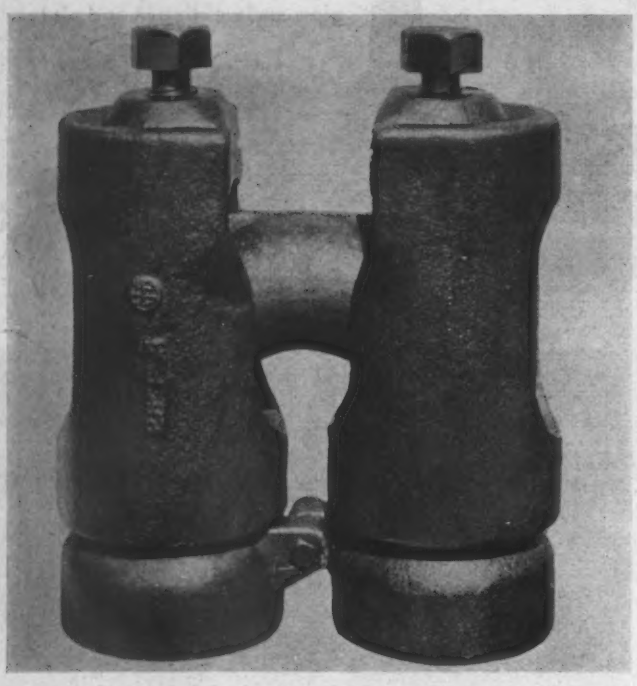
CHICAGO 208 So. La Salle St.

LOS ANGELES 520 N. Anderson St.

HOUSTON 600 Bringhurst St.

TULSA 733 Mayo Building

THE GREATER MIDWEST PIPING SERVICE



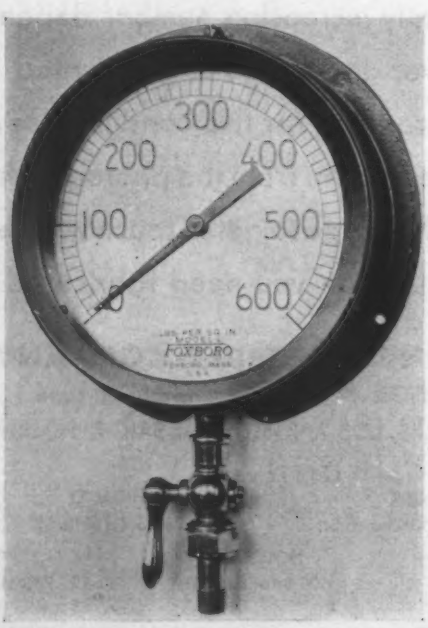
Ohio Return Bend

dismantling for tube cleaning as would be encountered with joints of other types in a fitting of this kind.

The return bend is simple in design, consisting of yoke, housing, tube end pieces, set screws, set locks, and U bend. In installing the fittings tubes are rolled into the tube end pieces, these pieces being connected by a bolt through the slotted hole in the plug. Then the housings are slipped over the tube ends one-eighth of a turn out of position and turned into place. This is followed by the insertion of the U bend then putting the set lock with screw in place and tightening the set screw. The connection of the tube end pieces by the use of a bolt through the slotted holes provides sufficient flexibility to compensate for the difference in expansion between the tube end pieces and the U bend.

PRESSURE GAUGES, METERS, CONTROLLERS

The Foxboro Company, Foxboro, Massachusetts, is exhibiting the new refinery pressure gauge. This gauge features a steel bourdon spring, and hardened steel working parts. The use of steel alloys allows it to stand up under hard service and not give way in case of fire. Besides this gauge, the exhibit is featuring new heavy forged steel orifice meters for safely measuring flows of liquids under high pressures up to 2500 pounds or 5000 pounds per square inch. Other instruments being shown include a flow ratio controller for proper proportionment of flows and a differential limit controller for accurately metering the widely varying flows found in the gas industry.

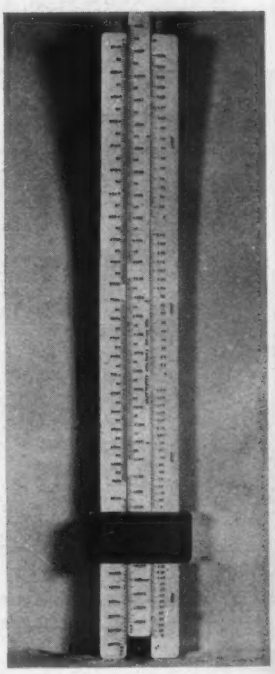


Foxboro Gauge

TANK CAR CALCULATOR

Refinery Supply Company, Tulsa, is showing the AC-ME tank car calculator. The purpose of this calculator is to figure corrected tank car volumes, scales being provided for tank cars of 6000 gallons, 8000 gallons, and 10,000 gallons capacity. Temperature scales are also provided for oil of various gravity, that is, there is a temperature scale for the following coefficients of expansion: .0004, .0005, .0006, and .0007.

The calculator is 18 inches long and is made of mahogany faced with white celluloid on which the various scales are imprinted. The scales are accurately graduated and the instrument may be read accurately to within one gallon. In operating the calculator pick out the proper temperature scale and set the corresponding pointer on the temperature at which the car was gauged. Then set hairline indicator on volume gauged, found on scale "B," and read on scale "C" the volume corrected to 60°F. Move the slide so that the hairline indicator in its present position indicates on scale "B" the shell full capacity of the car. Then the pointer will indicate on scale "A" (under the proper coefficient of expansion) the temperature at which the tank car will be shell full.

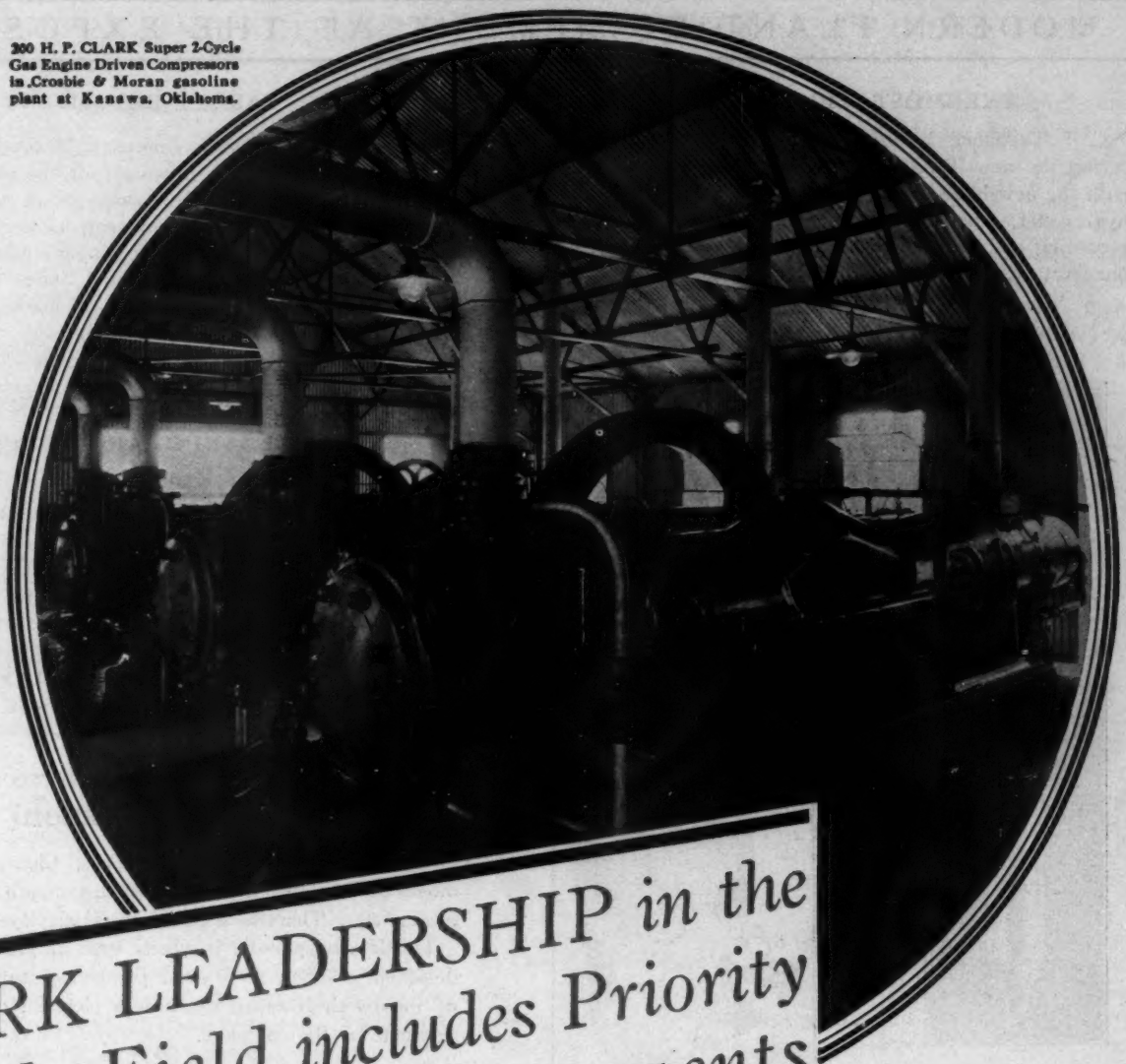


STILL TUBES

Allegheny Steel Company, St. Louis, is showing Allegheny metal, Ascaloy 33, 44, 55, and 66, comprising the entire range of chrome-nickel and chromium alloys as manufactured under American Stainless Steel Company's patent and the Krupp patent now controlled by Foundation Chemical Company. These various alloys have high resistance to erosion, corrosion, abrasion and high temperature, including the property of maintaining relatively high tensiles at elevated temperatures.

The most popular application has been found in the refining department for such items as cracking still tubes, lining of vessels, nubble caps and trays, heat exchange tubes, condenser tubes, headers, preheaters, and air heaters. By controlling the carbon content in Allegheny metal, the 18 and eight alloy, the manufacturers claim the elimination of carburization at all temperatures up to approximately 1725 degrees.

The groups of alloys have varying resistances to scaling from temperatures, Ascoloy 33 having resistance up to 1500 degrees, Allegheny metal and Ascoloy up to 1650 degrees and 1700 degrees, Ascoloy 44 up to 2100 degrees and Ascoloy 55 up to 2150 degrees.



300 H. P. CLARK Super 2-Cycle Gas Engine Driven Compressors in Crosbie & Moran gasoline plant at Kanawa, Oklahoma.

CLARK LEADERSHIP in the 2-Cycle Field includes Priority in Pioneering Improvements

Look in the New Plants for CLARK "Super 2-Cycle" Engine Driven Compressors. . . . . .

CLARK

Vertical and Horizontal Compressors - - Drilling Engines - - Pumping Engines - - Engine-Driven Generator Units. . . .

The sales leadership gained and held by CLARK 2-Cycle Engines is soundly based on leadership in designing 2-cycle machines - - which are improved whenever engineering progress makes possible.

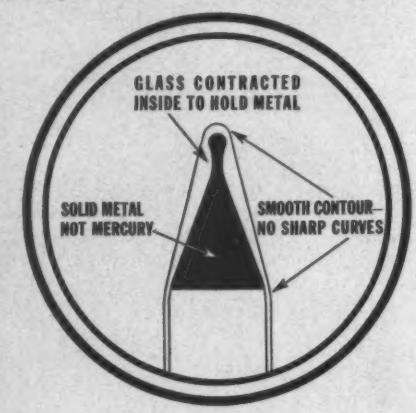
Notable among many features contributed by CLARK to oil country engine design are: the CLARK patented Fuel Saver; the CLARK Variable Load Governor; forced feed filtered lubrication on to bearings; water cooled exhaust port bridges; centralized control; clearance pockets on all compressor cylinders; die forged connecting rods, etc., etc

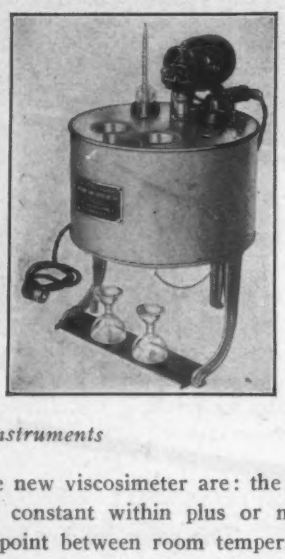
CLARK BROS. CO., Olean, N. Y.

Export Office: 150 Broadway, New York City
Mid-Continent Sales Offices: Tulsa and Fort Worth
Warehouses: Tulsa, Oklahoma; McCamey and Sweetwater, Texas; Artesia, New Mexico
California: Smith, Booth, Usher Company, Los Angeles

THERMOSTATIC VISCOSIMETER

C. J. Tagliabue Manufacturing Company, Brooklyn, is featuring the new TAG Saybolt thermostatic viscosimeter along with the new hydrometer. Other exhibits include thermometer, hydrometer, standard oil testing instruments for laboratory, recording and indicating thermometers and a complete line of temperature, pressure and liquid level controllers for the plant.





TAG Instruments

Some of the features of the new viscosimeter are: the temperature of the bath is held constant within plus or minue 1/10 of a degree at any test point between room temperature and 220°F. This instrument allows easy setting to the correct temperature by means so a pilot lamp can indicate whether the contacts are open or closed by the appearance of the lamp. A flickering light seen from any point of the room shows that the bath is being controlled and is operating properly. Sticking contacts are prevented by one contact being oscillated by means of a cam on the propeller shaft. The bath heats rapidly to any test point and the oil is used instead of water as a liquid. The stirring is adequate and insures uniformity of temperature and maintains the proper difference between tube temperature and bath temperature required for testing materials.

TAG HYDROMETER

The new TAG hydrometer has been designed with a streamline tip which affords no corners for collecting dirt and no chance of it being pulled out of the hand in wiping. Instead of the usual mercury ballast, a low melting point alloy in a solid piece has been firmly and ingeniously fastened in the bottom of the instrument so that it cannot come loose even when the hydrometer is inverted.

SAFETY EQUIPMENT

Mine Safety Appliances Company, Pittsburgh, is showing a complete line of safety equipment for the petroleum industry. One of the features of the exhibit is an extensive array of respiratory and protective equipment, including the permissible combination hose mask and tank gauger's mask, which have recently been approved by the United States Bureau of Mines. In addition to many other forms of masks, this company is showing approved oxygen breathing apparatus, electric cap lamps, gas detectors and recorders, miscellaneous protective and safety clothing and various first aid materials.

CLEANING APPARATUS

Oakite Products, Inc., New York City, is featuring improved methods for cleaning materials for salvaging out-of-service equipment. For the demonstrations the company is collecting daily from the various local companies, used equipment, and is cleaning it in a regular size supply yard tank. One of the interesting features of the method developments is a small drum type cleaning tank, for small parts cleaning, which can be reproduced by any producing company with available material for a minimum of expense. Interesting literature describing daily cleaning operations in the petroleum industry is distributed at the booth.

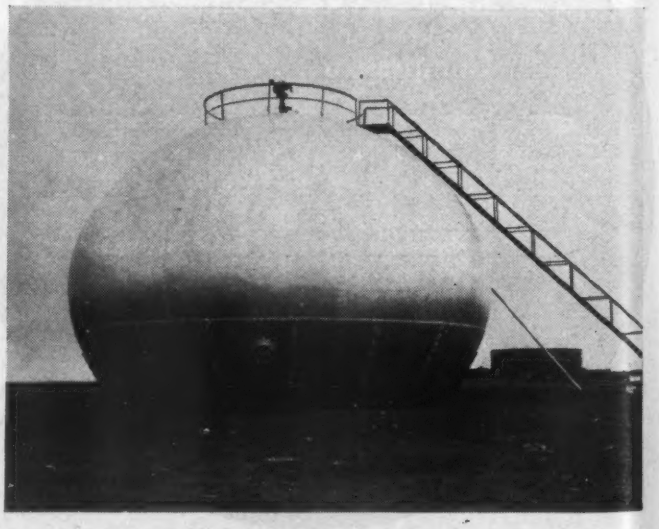
HORTONSPHEROID

Chicago Bridge and Iron Works, Chicago, is showing a model of the Hortonspheroid which is approximately four feet in diameter. There is also a pictorial display of this equipment.

The Hortonspheroid is a new type of pressure storage tank designed to supply at 10 or 15 pounds pressure. The remainder of the booth is taken up with a pictorial display of various products of the company.

The Wiggins floating roof rests directly on the oil thereby covering the entire surface and preventing evaporation or fire in oil storage tanks. The Wiggins breather roof is fastened solidly to the top of a tank and flexes up and down like a huge diaphragm. This permits expansion and contraction on the contents without loss of valuable vapor.

The exhibit also includes a number of refinery plate work products, such as bubble towers, condenser boxes, cooling towers and elevated water tanks.



Hortonspheroid

POR-PAIL

Wilson & Bennett Manufacturing Company, Chicago, is showing a complete line of steel shipping drums, pails and cans used by the petroleum industry for the shipment and sale of lubricants. The future of the display is a continuous pouring demonstration of the Por-Pail. This piece of equipment is a five-gallon steel oil drum which is of permanent utility. The exhibit of lithographed containers showing the advance made in the reproduction of hard, brilliant colors on steel is particularly interesting. There is also a display of oil drums, grease drums and pails of one to 65 gallons, showing developments in package design, types of plugs, openings and closures.

Por-Pail

PROPORTIONING PUMPS

Hills-McCanna Company, Chicago, is featuring five of its products. Among the proportioning pumps being shown is the type G Duriron fitted model recommended for feeding sulphuric acid of various concentrations. In this line of pumps there are types made of various alloys for injecting other chemicals used in the treatment of crude oils and distillates. The construction of these pumps embodies guided plungers which maintain the pistons in perfect alignment. Capacities of these pumps range to 308 gallons per hour under pressures to 4000 pounds.

OUTLET VALVES

Young tank car outlet valves prevent leakage by a three point seal. These valves may be installed in any tank car equipped with an outlet leg. Other features of the exhibit include Thermometer and Pyrometer protection tubes, force feed lubricators, low water alarms, fusible plugs, and air cocks.

LIQUID SAMPLER

This sampler obtains average, composite samples at three levels of storage tank and tank cars at one operation. Light or viscous fluids may be sampled by means of this device.

CEMENT

Quigley Furnace Specialties Company, New York City, is exhibiting a full line of cements including Hytempite, a high temperature cement used for oil still and boiler furnace construction and for maintenance and repairs of firebrick linings; Ganisand, a granular refractory used for furnace repairs, monolithic baffles and maintenance on boilers and stills; and Q-Seal, a plastic, joint-sealing compound for sealing screw threads, flange and gasket joints on steam, air, oil, gasoline, kerosene and other lines.

The Quigley gun is used to shoot refractory and concrete mixtures for boiler furnace maintenance repairs and for building and repairing monolithic baffles.

Other products being shown by the company are: Q-Chrome, a neutral base refractory cement for furnace linings; Quigley acid-proof cement, for metal, concrete, stucco and wood surfaces; and Annite, a highly active and colloidal cleaning compound, a detergent which cleans without chemical action by emulsifying oils and greases.

"PYREX" PLANT EQUIPMENT

Corning Glass Works, Corning, New York, has on display three assembled sections of a "Pyrex" resistant glass fractionating column. Each section is 13 inches in diameter by 10 inches in height. The construction is such that it allows for the addition of any required number of sections. For use in the larger fractionating units there is shown a "Pyrex" resistant glass plate with three bubble-caps. This plate is 23¾ inches in diameter. Each cap has a slot area of 7½ square inches. Another new product, flanged piping, is shown assembled into a small piping system.

LABORATORY WARE

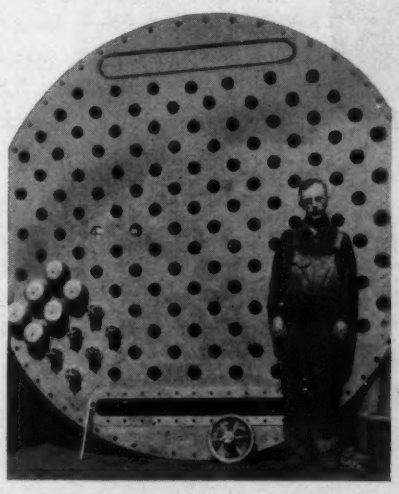
Apparatus for use in oil laboratories such as distillations, for determinations of sulphur, moisture and viscosity and other similar articles are on display. One of the very interesting features of this exhibit is the daily demonstration of "Pyrex" resistant glass lamp work by one of the master craftsman from the factory.

PYREX RESISTANT GLASS INSULATORS

Eight types of power-line insulators are being shown. These insulators are characterized by their homogeneous structure and high permanent dielectric strength. Two types of telephone insulators and four types of radio insulators are on display. The small dielectric losses from these insulators have been the features of this equipment.

BUBBLE TOWER TRAY

Oil Conservation Engineering Company, Cleveland, is showing the Oceco one piece bubble tower tray which is cast in one piece from special heat resisting, cast iron reinforced underneath so that warping is prevented. The bubble caps screw into the tray.



Oceco Bubble Tower Tray

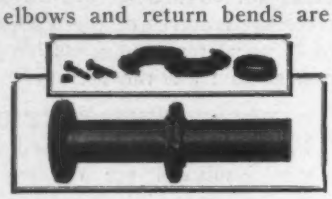
VENT VALVES

This valve is a dead weight type designed for positive operation under the most severe conditions. The valve opens at a pressure or vacuum of one-half ounce per square inch. However these valves can be furnished to open at any pressure from one-half ounce to one pound per square inch or at a pressure of one-quarter ounce per square inch. For these low pressures a flat disc valve and guide is used instead of the standard stem guide valve. Body castings

are semi-steel while the valve, valve stems, valve seats and guides are of a special aluminum developed to meet corrosive conditions in oil tanks. Inspection covers, that swing back exposing the valves, are released by a few turns of the single hand wheel.

PIPE COUPLINGS

In the grooved pipe the groove is not as deep rooted as the standard threads—less metal being removed in the operation. The pipe is easily grooved on the job. These pipes may be removed and laid in a new location without reconditioning. Cleaning of the pipe and coils is both possible and practical. These couplings are especially adaptable for making coils such as condensers, coolers, and heat exchangers. Standard tees, elbows and return bends are available. For connecting grooved pipe to other piping it is only necessary to use an adapter in the form of a nipple threaded on one end and grooved on the other.



LOOK BOXES

The glass in the look boxes is a complete cylinder which gives an unobstructed view of the stream and allows light to enter the box from all sides. The cylinder is tough Pyrex glass so that breakage is practically eliminated. A five-inch hand hole fitted with a gas-tight aluminum cover gives access to the inside of the box. The bottom casting is also tapped for a sample cock. The studs are for standard four-inch companion flanges and the center to center distances are the same as are found in the majority of receiving houses now using the old type look box, making it simple to install this modern equipment. The top casting is tapped for a two-inch gas line.

SAFETY TANK WINCH

With this winch a load of 2500 pounds can be handled with a pull of 70 pounds on the crank. It is for use with swing lines up to and including 10 inches in diameter on tanks as high as 40 feet. It has a drum six inches in diameter by 10 inches long with a capacity for ⅜-inch cable of 40 feet in one warp; 82 feet in two warps. Permanent lubrication is provided by graphite bronze bushings throughout and brass thrust washers at the ends of the drum and worm.

GAUGE AND THIEF HATCH

The use of this thief hatch is claimed to be air-tight, water-tight and spark-proof, thus eliminating heavy losses through evaporation, firing of emitted vapors and admission of water. This hatch uses no liquid seals or gaskets. It consists of a body designed to bolt or rivet to the roof of the tank or screw onto a nipple. It is with a cover

which is self closing and is operated by a foot lever. In this cover there is a seating ring of white metal which results in a gas-tight joint which is also spark-proof. It is placed in the cover so that it is protected from injury when lowering gauges or thiefs into the tank.

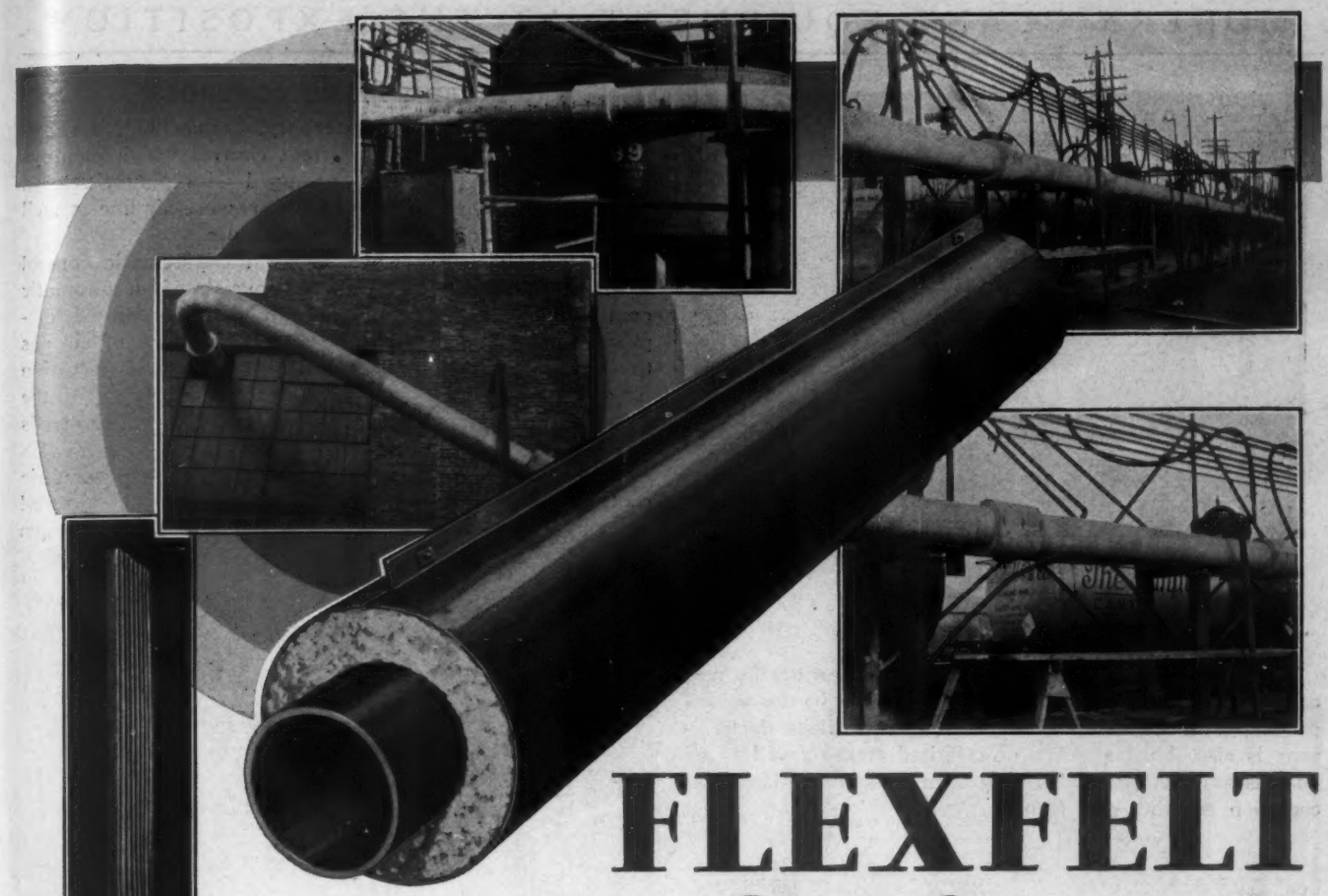
STEAM TRAP

Armstrong Machine Works, Three Rivers, Michigan, is exhibiting the Armstrong steam trap which operates by the rise and fall of an inverted submerged bucket. The valve is opened and closed by the motion of this bucket. The open end of the bucket is directly over the inlet in the bottom of the trap, the outlet of the trap being at the top. Water flowing through the inlet onto the trap travels up past the bucket, then out through the valve, which is in

the top of the trap. Should steam enter it, it will collect in the bucket, causing it to float and quickly close the valve. This steam will condense and steam or water will enter to take its place. If steam enters, the bucket will continue to float, but if water enters, the bucket loses its buoyancy and sinks, opening the valve and the discharge takes place. Air entering the trap is caught in the bucket and passes out through the vent in the top of the bucket and collects in the top of the trap, passing out during the discharge. Any steam passing through the vent is condensed by the surrounding cool water. These traps are fitted with different valves for different pressures.

DISPLACEMENT METERS

The Ralph N. Brodie Company, Oakland, California, has on display a complete line of displacement meters for use on ship loading terminals, bulk plants, truck tanks, and refinery units. In addition to these meters they are featuring the universal displacement meter for six-inch lines which has an operating range of 200 to 1000 gallons per minute. This meter is specially designed for use on pipe lines, unloading barges and other installations requiring large capacity.



FLEXFELT
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We fabricate and design removable Rock Wool metal covered tower and still insulation.

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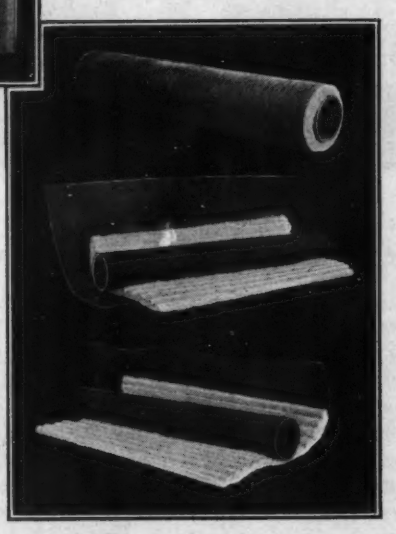

Made by fabricating Gimco Rock Wool which has been treated and processed while in the molten state to form tough, annealed fibers, that entrap 90% of their volume in dead air.

We believe the importance of insulation merits the same careful planning as applied to every other detail of Refinery Equipment. With this thought in mind, we have designed insulation particularly adapted for use in the oil industry. It incorporates the desirable features of Efficiency, Durability and Salvageability.

Let us design the insulation for your Refinery Equipment.

GIMCO PRODUCTS:

- Gimco Rock Wool.
- Gimco Rock Wool Flexfelt.
- Gimco Rock Wool Pipe Covering.
- Gimco No. 320 Monolithic Heat Insulating Cement.
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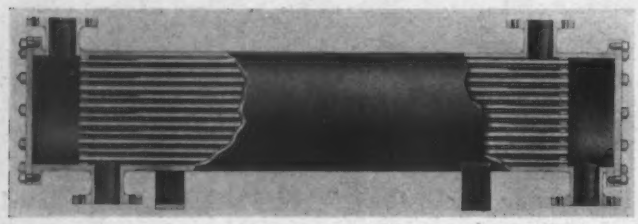
Gimco ROCK WOOL

Calorized Tube

CALORIZED STEEL TUBES

The Calorizing Company, Pittsburgh, is featuring the new calorized steel tubes and tube supports shown in the accompanying illustrations. In addition to these exhibits the company is also showing a line of calorized cracking still tubes, miscellaneous chrome-nickel alloy castings and calorized steel corrosion resisting pipe fittings.



Griscom-Russell Heat Exchanger

EQUAFLO EXCHANGER

Griscom-Russel Company, New York City, is showing the new Equaflo exchanger which is designed so that cross baffles in the shells are eliminated. Heretofore baffles have been essential in heat exchangers to secure intimate contact between the liquid in the shell and the outside of the tubes. Such baffles may cause collections of dirt or other solid matter difficult to remove. In this device the tubes are swaged down at one end to permit closer spacing in the shell and at the same time retain sufficient bridge wall in the tube sheets for strength. The tubes are so placed that the area of flow through the shell may be equal to the area of flow through the tubes. This exchanger is furnished in different arrangements and materials for various service requirements.

TURBO-CONTACTOR

Turbo-Mixer Corporation, New York City, is showing working models of the Turbo-contacter for the contacting of fullers earth and oil, showing the extreme speed with which the Turbo-mixer breaks up the fullers earth to its ground particles size, resulting in faster contacting and lower earth requirements.

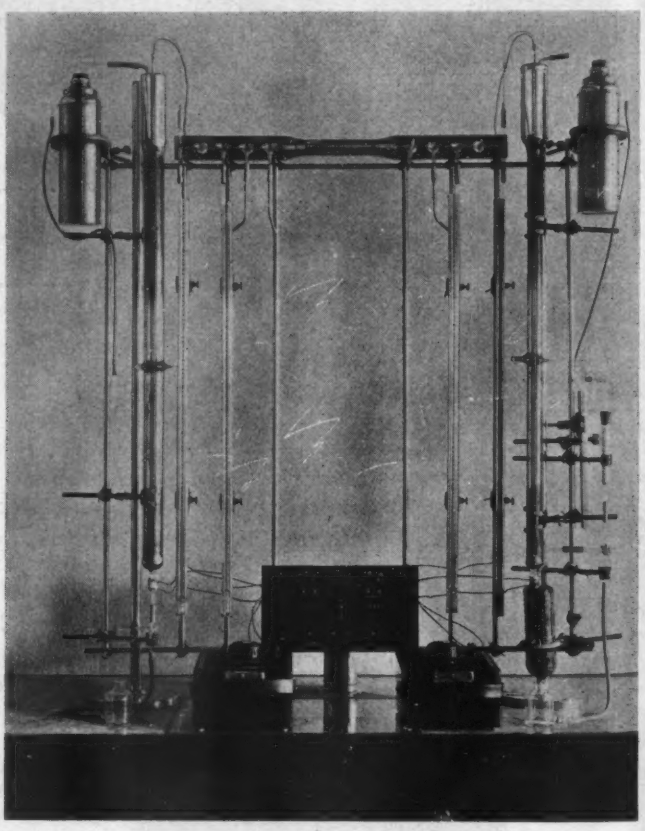
Other features of the exhibit include working models of Turbo-treater for treating oils and distillates and the Turbo-mixer for the instantaneous preparation of drilling mud.

INTERMITTENT CONTROL

The Bristol Company, Waterbury, Connecticut, is showing a working model intermittent control which employs the Bristol cycle controller arranged with piping colored to show the low, medium and high pressure air line as well as the operation of the system in miniature.

Another device on display is for the automatic control of air-gas lift plants. This device consists of an automatic control instrument which through motor operated diaphragm valves automatically controls the flow of air gas to the wells at regular intervals. Any cycle of operation may be secured and determined by the character of the rock formation to secure the maximum flow from the wells where air-gas lift stations are in operation.

Other features of this exhibit include electric pyrometric control for refineries, industrial thermometer, air operated control equipment, recording pressure guages and diaphragm valves.

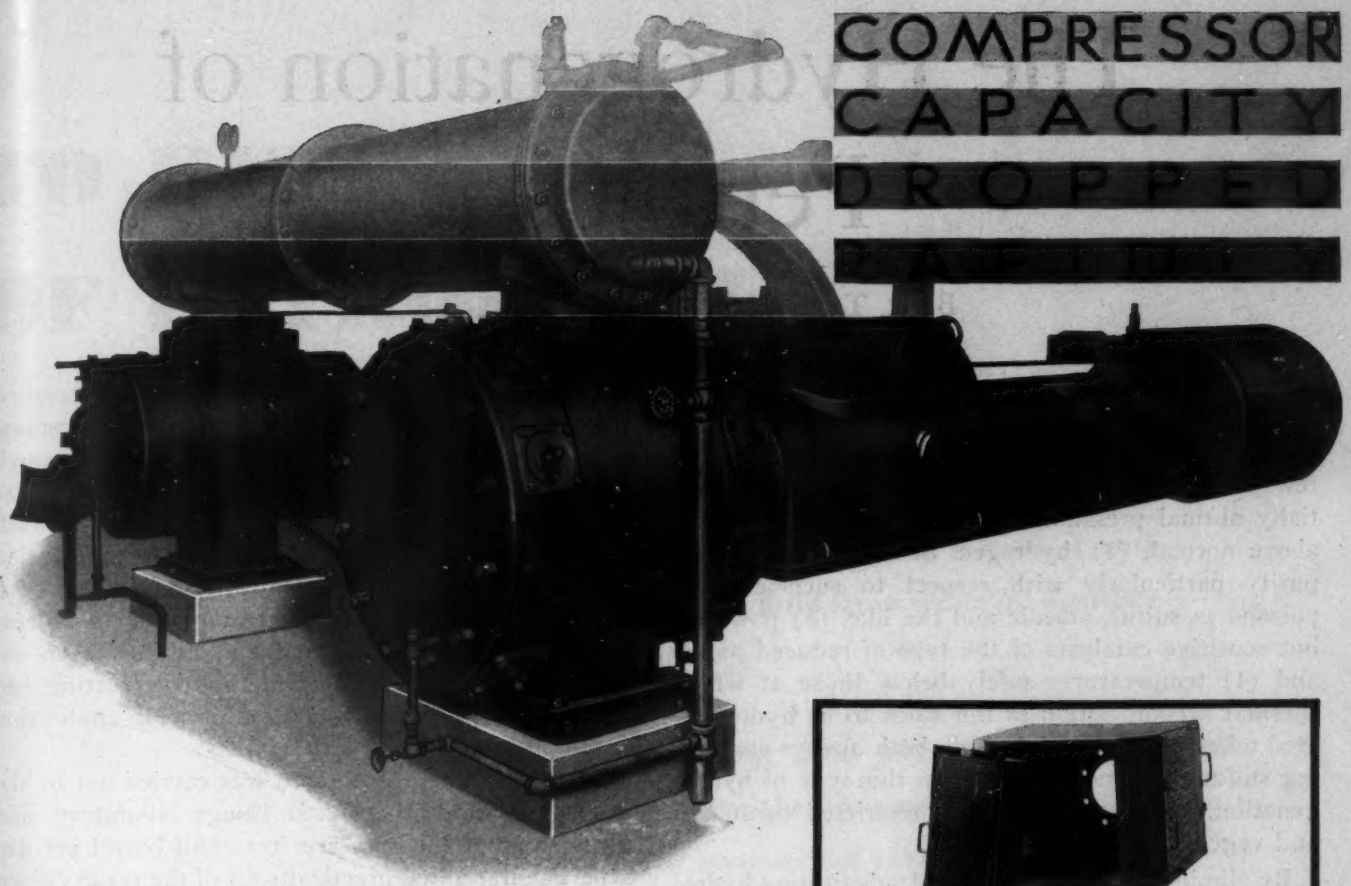


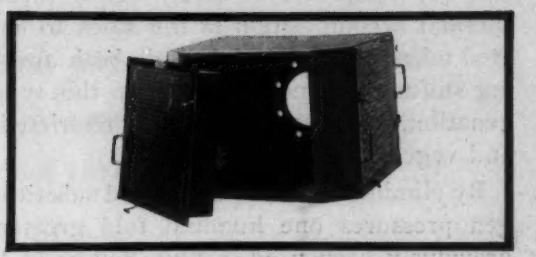
Podbielniak's Apparatus

FRACTIONAL DISTILLATION APPARATUS

Walter J. Podbielniak is showing the improved fractional distillation analysis apparatus, in general use for the accurate analysis of gaseous and volatile liquid mixtures into their component hydrocarbons. For the first time the precision model fractionating column is being exhibited, showing many new and radical changes in its design that are combined to make it free from the annoyance of a liquid reflux cooling bath and more resistant to thermal and mechanical shock. Precision model barometric type manometers on display appear to be about twice as sensitive as the usual U-type manometer.

A novel feature of the apparatus is a mechanical "robot" which effects semi-automatic operation and rings for the human operator when it finds itself inadequate for some special adjustment or step in the operation.





Type SCF three unit air filter

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AMERICAN AIR FILTERS

COMBINING THE PRODUCTS FORMERLY MANUFACTURED UNDER THE FOLLOWING TRADE MARKS:

MIDWEST TRADE MARK
Reed Air TRADE MARK filters ALL METAL
NATIONAL AIR FILTERS TRADE MARK

The Firestone Tire & Rubber Company installed a large air compressor to provide about one-third of the compressed air required by their Akron plant. The intake duct was carried to the roof of the power house and left entirely open there at a point near the vent from a pulverizing mill which handles about 1,000 tons of coal daily. The effect of dust-laden air was immediately evident. Compressor capacity dropped rapidly during the first six weeks and inspection showed that the valves and ports were heavily incrusted with grease, soot and dirt, necessitating cleaning.

American Air Filters were installed in the intake duct. Capacity is now maintained steadily, due to clean valves and elimination of wear on cylinders and pistons. It is necessary to clean the compressor only twice a year. The gross savings in labor on valve cleaning is placed very conservatively in a survey by the A. C. Nielsen Co., Engineers, at $1,000 a year.

American Air Filters will reduce operating costs and increase the efficiency of your compressors and oil engines. Send for list of satisfied users in your vicinity and complete descriptive literature. No obligation.

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HOUSTON FORT WORTH DENVER

The Hydrogenation of Petroleum[1]

By R. T. HASLAM* and R. P. RUSSELL**

THE conditions under which commercial hydrogenation has been practiced since the time of Sabatier have been restricted until the last few years to the use of (1) hydrogen at substantially normal pressure or two or three atmospheres above normal, (2) hydrogen of a high degree of purity particularly with respect to such catalyst poisons as sulfur, arsenic and the like, (3) powerful but sensitive catalysts of the type of reduced nickel and (4) temperatures safely below those at which thermal decomposition of the stock to be hydrogenated takes place. Coal and oil, both always containing sulfur, were not amenable to this type of hydrogenation, and it was therefore restricted to animal and vegetable fats and oils.

By eliminating the catalyst and substituting hydrogen pressures one hundred fold greater than had previously been used, a high degree of liquefaction was obtained but the oils thus produced contained relatively large percentages of oxygenated bodies of the cresolic type making the oils hard to crack or refine. The able and resourceful research organization of the I. G. Farbenindustrie, through their experimentation, recognized the need of greater hydrogenation intensity than obtainable with hydrogen pressures then commercially permissible and developed a line of sulfur-resistant catalysts which materially speeded up hydrogenation and caused the elimination of all the oxygen from the hydrogenated product. In addition, their long experience in the field of synthetic ammonia enabled them to devise apparatus and methods for better carrying out this type of hydrogenation in a continuous manner.

Some three years ago Standard Oil Company of New Jersey through its development company, joined with I. G. in the further development and commercialization of this method of treatment, and erected special laboratories for high pressure experimentation at the refinery of the former company's subsidiary, Standard Oil Company of Louisiana at Baton Rouge, Louisiana. Previous efforts had been largely directed towards the conversion of coal to gasoline or the conversion of asphaltic crudes and residual fuel oils to distillate naphthas and gas oils. Although work along these lines was continued with particular emphasis on the simplification of the process, much of the effort of the Baton Rouge staff, in cooperation with the I. G., was to broaden the use of the process. It is now felt that something more than a process of adding hydrogen to coal and oil has been developed, namely, a flexible method of treating and refining by the use of hydrogen of wide application in the oil industry.

The work herein presented was carried out by the research staff of the Baton Rouge laboratory, and while some of the data are from half barrel per day experimental units, practically all of the results given also have been demonstrated commercially in a one hundred barrel per day pilot or demonstration plant erected about two years ago at Baton Rouge along the general lines of the larger plants of the I. G. Farbenindustrie in Germany.

It will be understood that disclosures to be made, and the process and its applications as described are fully covered either by patents issued or by applications for patents.

DESCRIPTION OF PROCESS

In each of the major applications of hydrogenation discussed in this paper the equipment and even the arrangement of this equipment is essentially the same, the results obtained being controlled by suitable alteration of operating conditions. The charging stock together with sufficient hydrogen is pumped into a reaction vessel containing catalyst where at the desired temperature and at about 3000 pounds per square inch pressure the reaction is allowed to take place.

Hydrogen may be produced by any of the usual processes. Since the hydrogen does not need to be sulfur-free its production from coal or coke by the water-gas process is somewhat simpler than when the hydrogen is to be used for the production of ammonia. Hydrogen may also be produced by liquefaction and distillation of the easily condensable gases from by-product coke ovens, or electrolytically when economies permit. For the oil industry, with its generous supply of refinery and natural gas, hydrogen may be made by the treatment of hydrocar-

[1] Presented before the American Chemical Society, Petroleum Division, Cincinnati, and before The National Petroleum Association, Atlantic City.

* Vice president and general manager, Standard Oil Development Company.

** General manager, Hydro Engineering & Chemical Company.

[2] The term viscosity index used in these charts was devised by Dean and Davis, Chem. Met. Eng., Vol. 36, 618-9 (1929) and indicates the viscosity-temperature characteristics of the lubricating oil. Thus paraffinic oils such as Pennsylvania have a viscosity index of 100, and Coastal oils a viscosity dniex of from 0 to 20.

TO REFINERS OF PETROLEUM

The Pratt vapor phase cracking process offers a method of producing a natural anti-knock blending fluid from crude oil distillate or fuel oil.

This blending fluid added to an equal quantity of straight run gasoline will make a gasoline of commercial anti-knock rating.

The cost of producing Pratts blending fluid is comparable with operating costs of contemporary cracking processes.

A demonstrating unit is in operation and open for inspection.

The process has been developed to meet the requirements of the manufacturer of automotive distillates.

The industry's investigation of this successfully developed process is invited.

HEADQUARTERS DURING THE TULSA EXPOSITION
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▼

The Automotive Distillate Corporation

Licensors of the Pratt Vapor Phase Cracking Process

Continental Life Building

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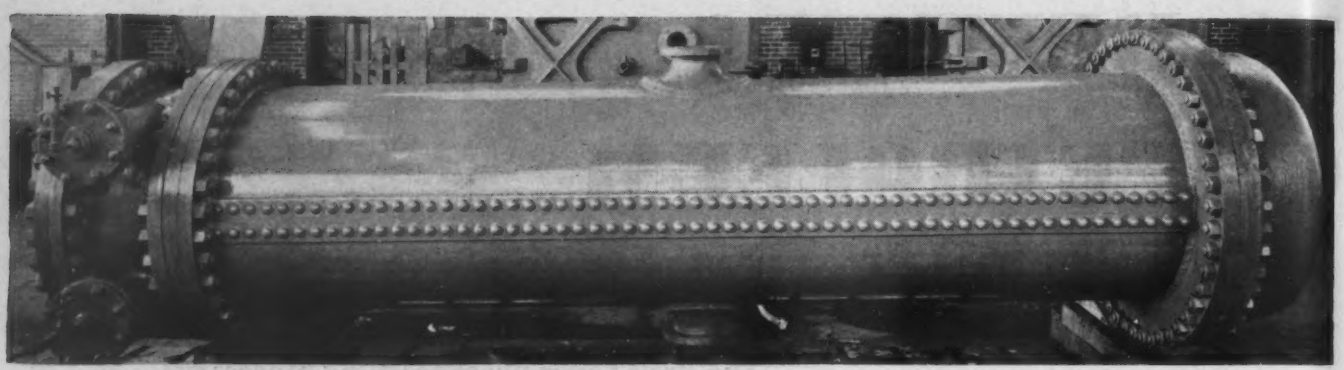
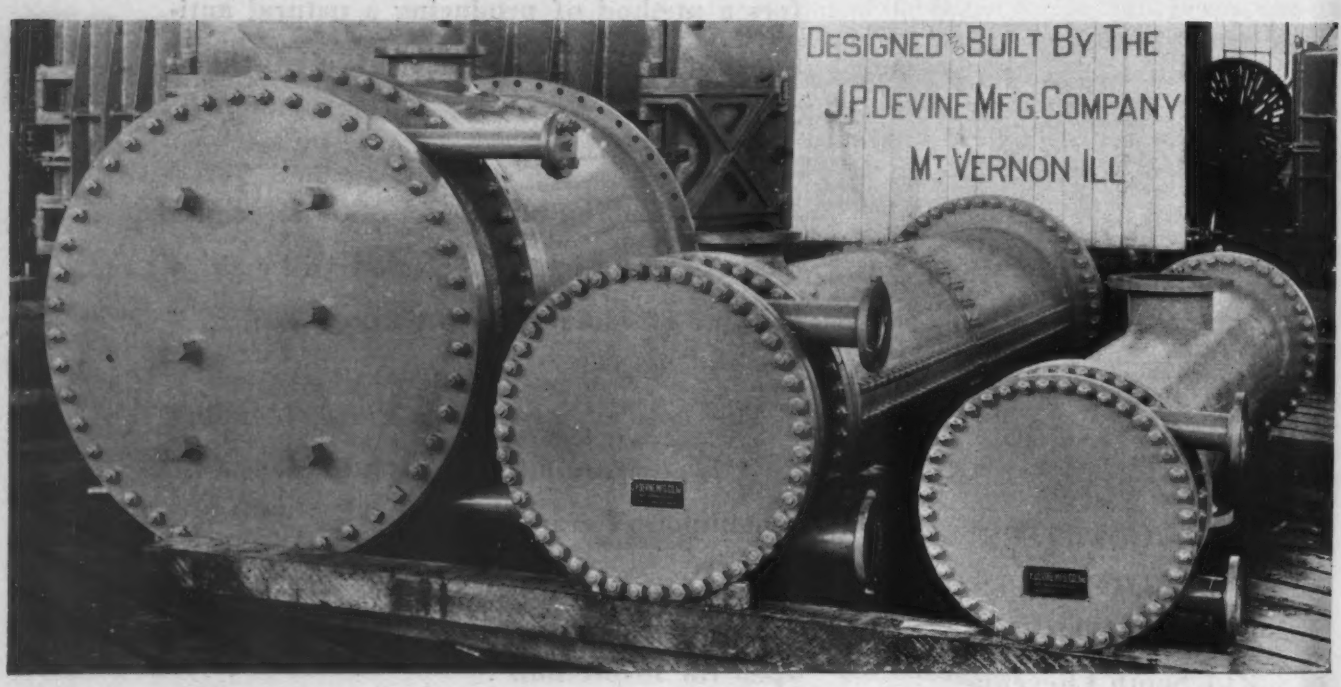
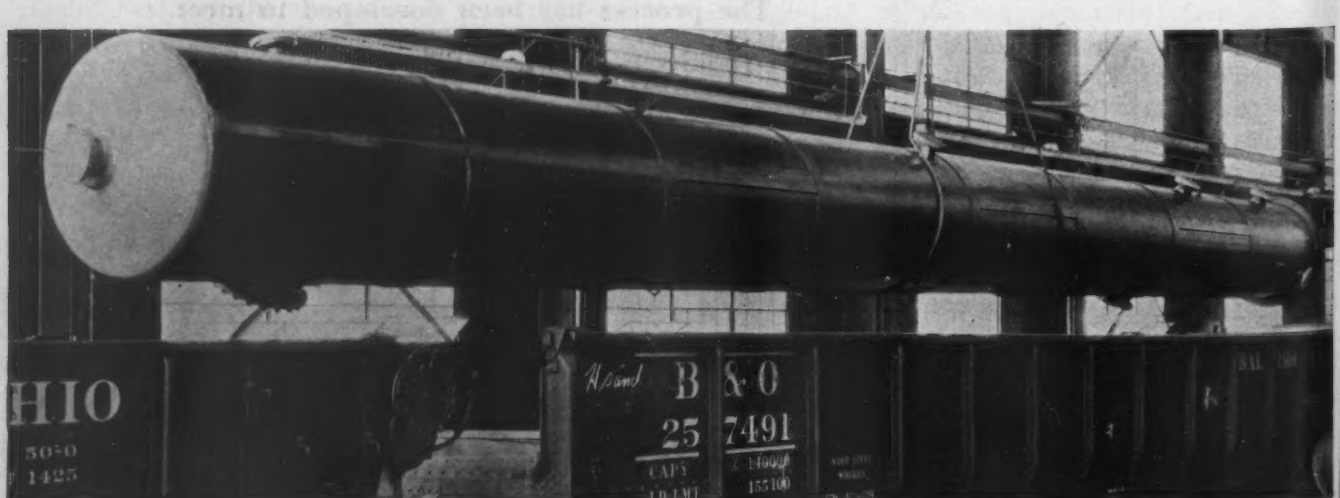


34"x12' Pressure Distillate Vapor Cond enser Built for a Large Texas Refiner



Another Texas Installation: 54" dia. Vacuum Condenser,300 square feet; 30" dia. Pressure Distillate Cooler; 20" dia. Pressure Distillate to Gasoline Vapor Heat Exchanger.



Rectifying Column, 4' x 60', Built for an Ohio Refinery

HEADQUARTERS DURING THE TULSA EXPOSITION — 214 South Cheyenne Street

Sales Representatives

For the Pratt Vapor Phase Cracking Process Equipment

IN the announcement on the preceeding page the Automotive Distillate Corporation presents a new and sensationally successful cracking process for the production of a natural Anti-Knock blending fluid.

As sales agents of the leased rights and fabricators of the equipment the J. P. Devine Manufacturing Company offers unusual plant facilities which are reflected in low costs and speedy completion of all contracts. Your commissions are executed "From Blue Print to Shipment Under One Roof". We will be glad to have our engineers present the details of the Pratt Vapor Phase Cracking Process and show you, too, some remarkable plant economies which are reflected in the equipment costs. The J. P. Devine Manufacturing Company specializes in the heaviest plate work.

Charles P. Jones
Pres.

J. P. DEVINE MANUFACTURING COMPANY, INC.
Mt. Vernon, Ill.

Sales Agents and Fabricators for the Automotive Distillate Corp. of St. Louis.

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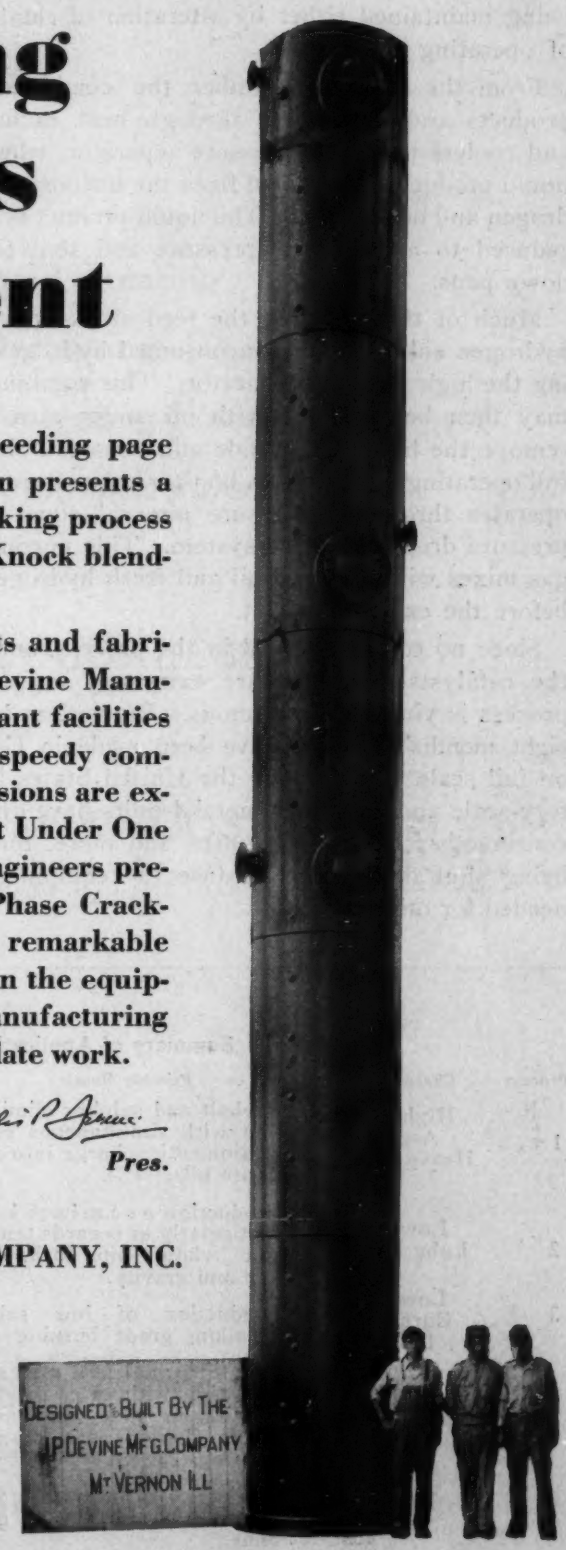

bons with steam in accordance with the following reactions: (1) $CH_4 + H_2O = CO + 3H_2$. (2) $CO + H_2O = CO_2 + H_2$. After scrubbing out the carbon dioxide the hydrogen is of sufficient purity. Catalysts are helpful and are usually used in carrying out each of the above reactions.

The oil and previously compressed hydrogen are mixed together and delivered to a coil furnace and thence to a catalyst-containing reaction vessel. The degree of hydrogenation is carefully controlled depending on the results desired, control in general being maintained either by alteration of catalyst or of operating conditions.

From the reaction chamber the combined final products and gases pass through heat exchangers and coolers to a high pressure separator, where the liquid product is separated from the unconsumed hydrogen and other gases. The liquid product is finally reduced to atmospheric pressure and sent to run-down pans.

Much of the sulfur in the feed stock appears as hydrogen sulfide in the unconsumed hydrogen leaving the high pressure separator. This combined gas may then be scrubbed with oil under pressure to remove the hydrogen sulfide and "boosted" back to full operating pressure in a booster compressor which operates through a pressure interval equal to the pressure drop across the system. This unconsumed gas mixes with the feed oil and fresh hydrogen just before the exchanger inlet.

Since no coke is formed in the process, and since the catalysts employed are extremely rugged, the process is virtually continuous. Runs of as long as eight months' duration have been made in Germany on full scale units, and in the United States laboratory-scale and small commercial units have operated continuously for three months and more, the units being shut down only because the equipment was needed for other purposes.

MAJOR ADAPTATIONS

There are five adaptations of hydrogenation which appear to be of most immediate importance in oil refining. These are: (1) The conversion of heavy, high-sulfur, asphaltic crude oils and refinery residues into gasoline and distillates low in sulfur and free from asphalt, without concurrent formation of coke.

(2) The alteration of low-grade lubricating distillates, to obtain high yields of lubricating oils of premium quality as to temperature-viscosity relationship, Conradson carbon, flash and gravity.

(3) The conversion of off-color, inferior burning oil distillates or light gas oils into high gravity, low sulfur, water white burning oils of excellent burning characteristics, with gasoline being the only other product except for a slight gas formation.

(4) The desulfurization, color and gum-stabilization of high-sulfur, badly gumming cracked naphthas without marked alteration in distillation range and without major loss in anti-knock valve. (It is possible to so operate as to actually better the anti-knock quality).

(5) The conversion of paraffinic type gas oils into low-sulfur, gum and color stable, good anti-knock gasolines without the production of coke or heavy product..

The processes described under (1), (2) and (3) above may all give more than 100 per cent volumetric yield; i.e., from 100 barrels of a residual charging stock the process will give 101 or more barrels of gasoline and gas oil. Similiarly, in treating 100 barrels of a low-grade lubricating distillate, 103 or more barrels of a mixture of gasoline and gas oil together with the improved lube oil will be obtained. In up-grading 100 barrels of a burning oil distillate, 102 or more barrels of product (approximately 70 per cent burning oil and 30 per cent gasoline) will be obtained. The various processes just mentioned are further summarized in Table I.

TABLE I.
Summary of Applications of Hydrogenation in Oil Refining

Process	Charging Stock	Primary Result	Yield of Approx. Volumetric					Per cent of sulfur in charge removed in process	Gas formation per cent by weight
			Gasoline per cent	Burning Oil per cent	Gas Oil per cent	Lube Oil per cent	Total Volumetric Yield per cent		
1	High Sulfur, Asphaltic Heavy Residue	Asphalt and sulphur elimination with simultaneous conversion entire charge into distillate oils.	30	..	71	..	101	65-85	2-3
2	Low Grade Lube Distillate	Production premium lube, particularly as regards temp.-visc. relationship, flash, carbon and gravity.	10	..	29	65	104	80-95	0.5-1.5
3	Low Grade Burning Oil Distillate	Production of low sulfur premium grade burning oil.	30	73	..	..	103	80-95	0.5-2
4	Cracked Naphtha	Desulfurization and gum stabilization without the deterioration in yield and knock rating characteristic of acid treating.	100	..	..	..	100	50-95	0.5
5	Paraffinic Gas Oil	Production of low sulfur, low gum, good anti-knock gasoline.	65-100	..	..	..	70-100	80-95	5-35

Whatever type of cracking unit you use, you can now, by direct connected vapor phase refining

DISCARD	-	Acid Treating
ELIMINATE	-	Rerunning
PREVENT	-	Processing Losses
CONSERVE	-	Antiknock Values

and

OBTAIN A STABLE, COLORLESS, NON-GUMMING MOTOR FUEL

AT ASTONISHINGLY LOW COST

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Keeping Pace with *the* Industry

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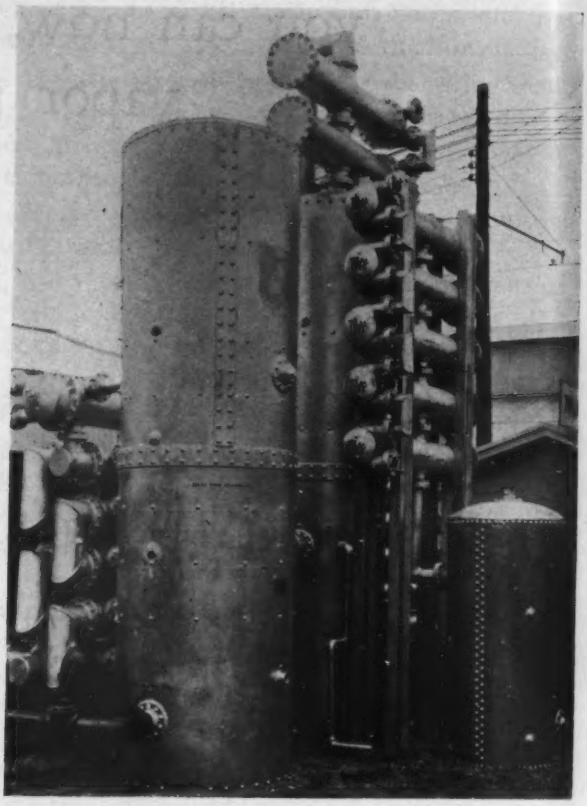

1927 →

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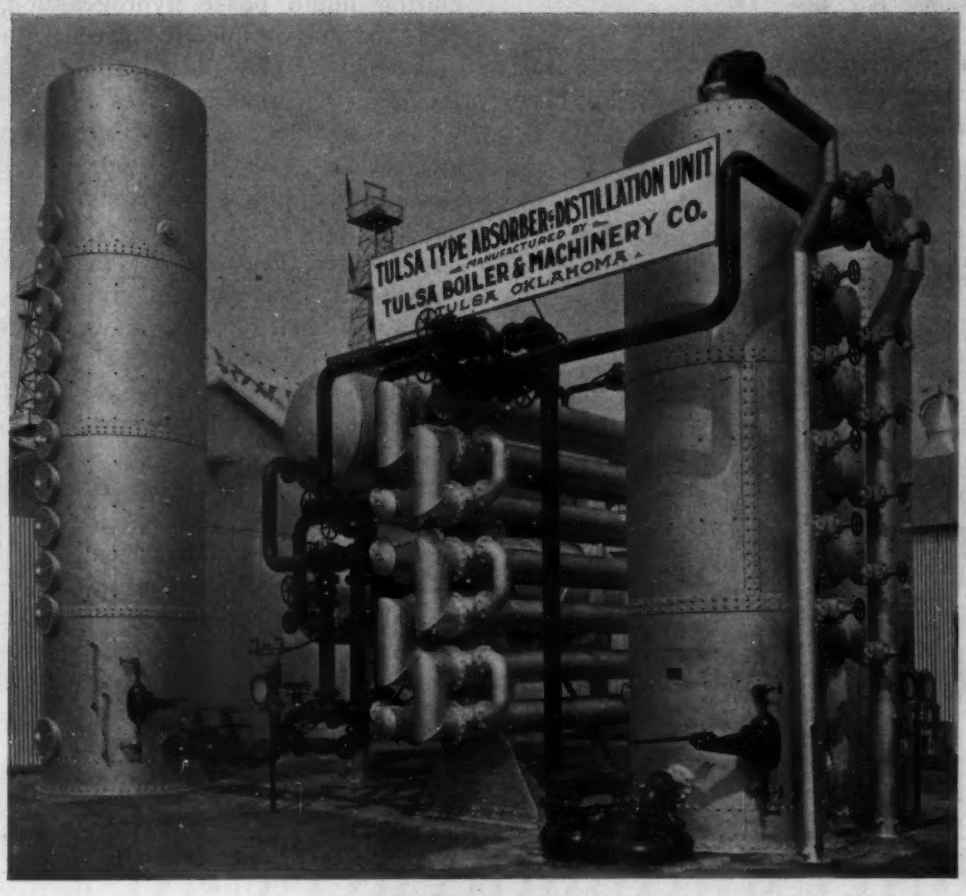

What ? IMPROVEMENTS

will TULSA TYPE *introduce to the* Industry

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Tulsa Boiler & Machinery Co.

Tulsa, Oklahoma

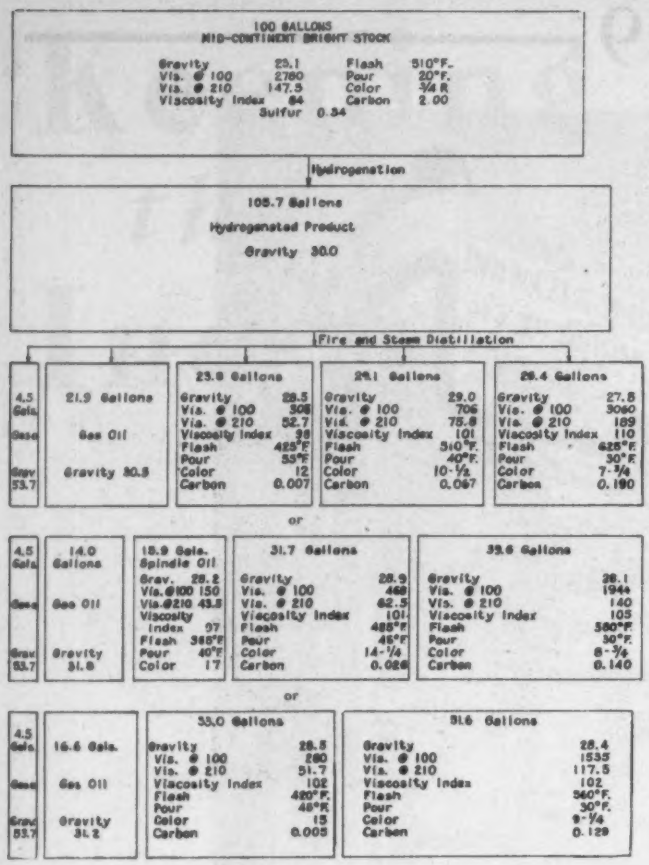


FIGURE 2

CONSERVATION OF REFINERY RESIDUES

The conversion of coal or heavy, asphaltic, high-sulfur products into high yields of gasoline is probably the most widely discussed adaptation of hydrogenation. By the present methods of cracking, part of the charging stock is upgraded into light, valuable product in the form of gasoline, while the remainder is degraded into gas, coke, and heavy fuel oil, all of lesser value than the feed stock. In contradistinction to the present processes for cracking, hydrogenation may up-grade even up to 100 per cent of the charging stock, into lighter and lower boiling point products. This major difference from the other forms of increasing gasoline yield, and the ability to utilize materials practically impossible to handle by other existing methods, tended to make this application of hydrogenation appear spectacular.

For the hydrogenation of heavy asphaltic crudes or residues from these crude oils or from cracking processes, two types of operation may be used. The first of these takes place mainly in the liquid phase and serves to convert the heavy charging stock into 100 per cent or more by volume of product of a more highly paraffinic nature than the charge stock. The gasoline content may represent from five per cent to upwards of 35 per cent of the liquid product from this first stage in the operation and the balance is a distillate oil. If a higher yield of gasoline is desired, the heavier part of the product may be recycled in the same unit or the total product may be hydrogenated in the vapor phase in a separate unit and converted completely to gasoline.

During liquid phase hydrogenation, the asphalt content may be completely converted and two-thirds to three-fourths of all the sulfur in the charging stock eliminated. This sulfur comes out as hydrogen sulfide and is scrubbed out of the recycle gases as mentioned earlier. Even if the product charged is highly asphaltic and of high sulfur content, the gasoline produced is easily finished to give a low-sulfur, gum-stable product. The anti-knock value of the gasoline is dependent somewhat on conditions, particularly the type of charging stock—crude residues from Smackover, Venezuela, Colombia and similar crudes giving lower knock rating gasolines than residues from Mid-Continent crude. The gas-oil formed in the liquid phase operation, in addition to having a relatively low sulfur content, cracks to give a gasoline which finishes to specification easily even though the gas oil was produced by hydrogenating a high-sulfur, high asphalt crude or residue. The workability of this phase of the process has been demonstrated on fuel oil residues from reduced Crane-Upton, Panuco, Venezuela, Panhandle, Mid-Continent, Talang, Akar, Long Beach, Alamatoes, Smackover, Reagan and other crudes.

In general, it is felt that the early application of this phase of the hydrogenation process will be to run these heavy asphaltic products in the liquid

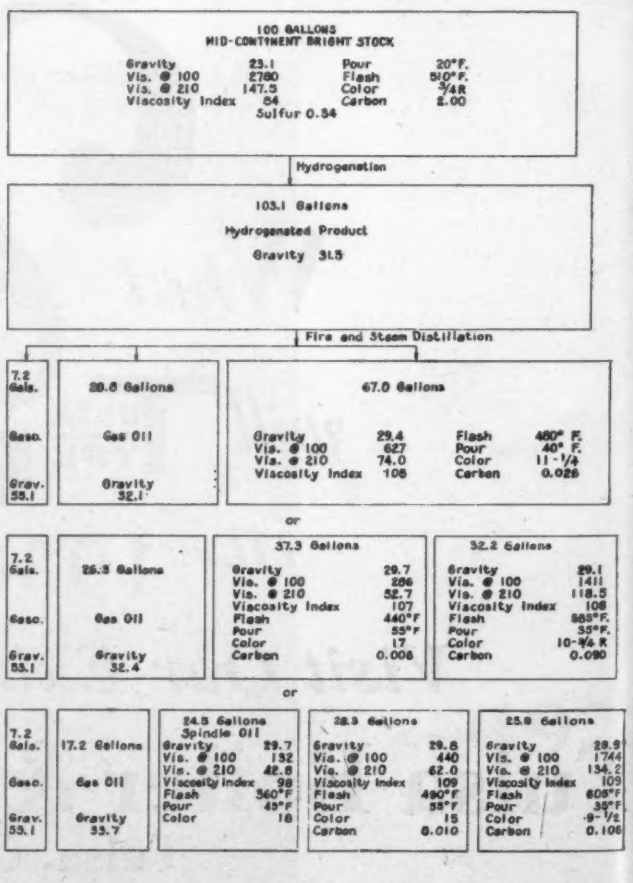
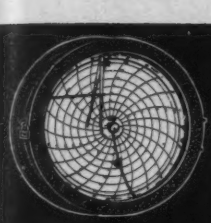
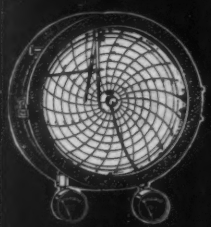


FIGURE 3

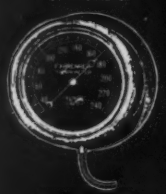


RECORDING THERMOMETERS AND PRESSURE GAGES

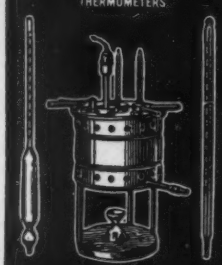


RECORDER - CONTROLLERS

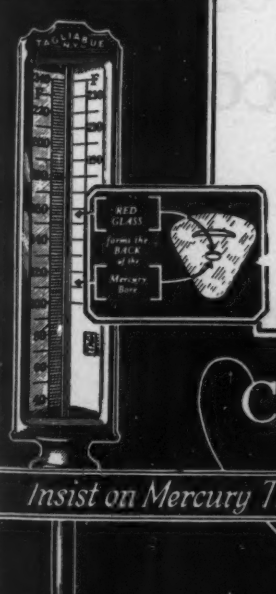
AUTOMATIC CONTROLLERS



DIAL - INDICATING THERMOMETERS



OIL TESTING INSTRUMENTS, THERMOMETERS, HYDROMETERS, ETC



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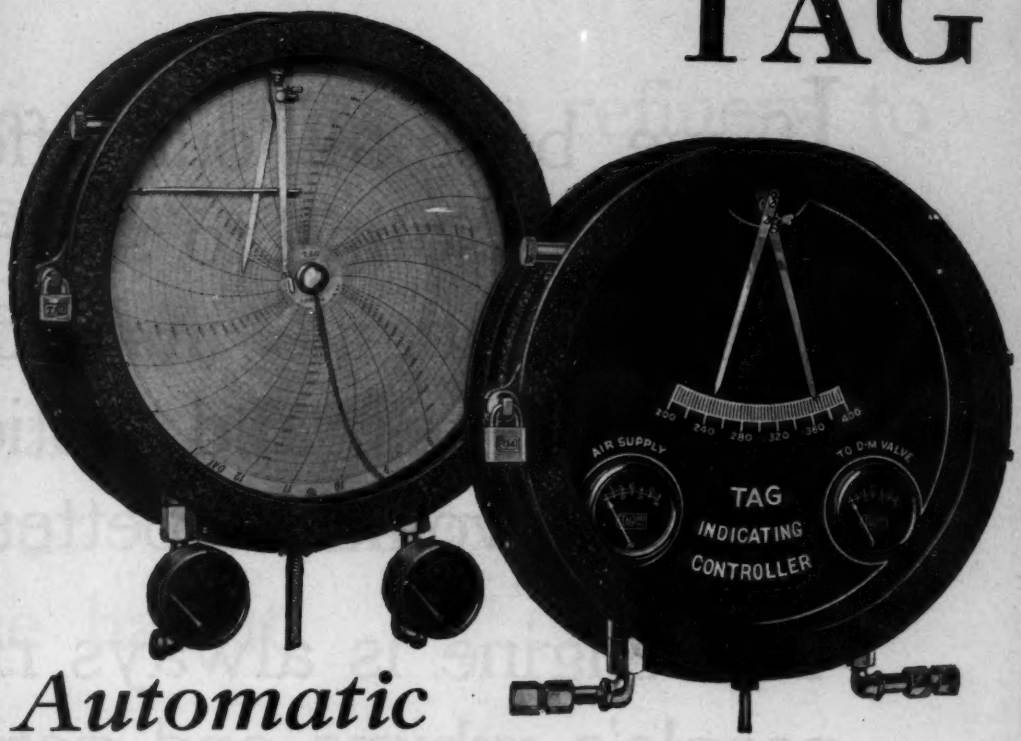

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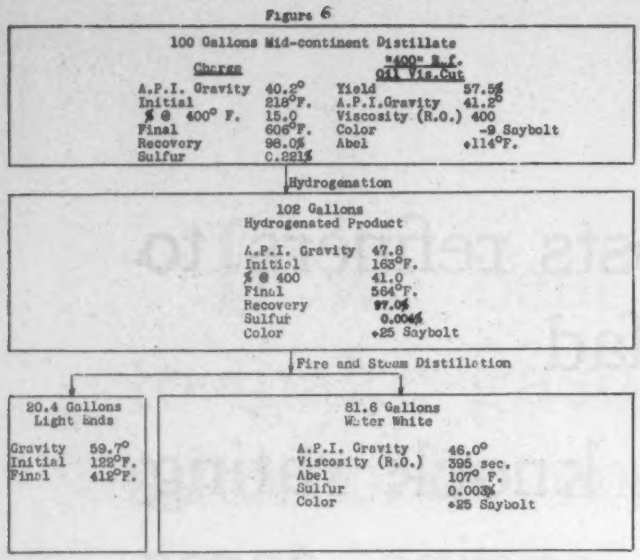
Figure 6



phase to produce small yields of gasoline and the balance gas-oil, with a total volumetric yield of 101 per cent to 104 per cent; the gas-oil to be cracked to produce gasoline in existing cracking equipment or converted into good knock-rating naphtha by hydrogenation as described later in this article. If the gas-oil is cracked in present apparatus, as much of the cracking plant tar as is needed for the production of steam and power in the refinery may be used as fuel and the balance returned to the hydrogenation unit. In this way the greatest use of present refinery facilities and gasoline yield can be obtained with a minimum hydrogen consumption. Depending upon the stock and operating conditions, a yield of 80 per cent to 90 per cent of gasoline may be obtained by this method. If none of the cracking coil tar was burned as fuel, the combined yield of gasoline would be approximately 100 per cent.

Some typical examples of the liquid phase operation are given in Table II in which a comparison is shown of the inspections of three heavy feed stocks before and after hydrogenation. All the asphalt present in the charge was converted into more paraffinic type products, about two-thirds of the sulfur eliminated and the entire product was a yellow distillate oil. As another example, it was found in hydrogenating a 7.2 A.P.I. gravity cracking-coil tar, that the sulfur was reduced from 2.77 per cent in the charge stock to 0.49 per cent in the total overhead, and this product contained 22.1 per cent of gasoline of 0.071 per cent sulfur without further treatment.

IMPROVEMENT OF LOW QUALITY LUBRICATING DISTILLATES

With the improvement in the internal combustion engine and particularly with the rapid expansion in air transportation there has developed an insistent demand for better motor lubricants. The modern motor lubricating oil, to give good service should have (1) a flat temperature viscosity relationship,

TABLE II.

Results of Hydrogenating Heavy Feed Stocks

	Topped Crane Upton Crude						
	Feed	Product Ex. 1	Product Ex. 2		Topped Nacona Crude		Cracking Coil Tar
Product % by Vol.		107.7*	100.5*		101.5*		98.9*
A.P.I. Gravity	23.4	35.8	35.1	24.9	37.5	12.4	23.5
I.B.P.	350	138	...	344	130	340	153
% @ 212	...	4.0	...	...	4.0	...	3.0
% @ 284	...	8.5	...	...	10.0	...	6.5
% @ 374	...	18.0	24.5	...	21.0	...	12.5
% @ 400	...	22.0	30.0	1.0	25.0	0.5	14.0
% @ 460	6.5	33.5	41.0	1.5	36.5	...	20.5
% @ 650	40.5	77.5	79.0	34.0	76.0	34.5	67.0
% @ 700	66.0	87.5	86.5	82.0	85.5	49.0	82.0
% Sulfur	1.25	0.189	0.530	0.760	0.108	0.702	0.246
% Gasoline* .	...	22.0	30.0	...	25.0	...	14.0
°A.P.I. Gasoline ...	...	57.3	57.6	...	60.8	...	56.4
% Sulfur in Gasoline ...	...	0.034	0.056	...	0.049	...	0.019

*Does not include a small yield of absorption naphtha produced concurrently.

(2) a high flash point, (3) a low Conradson carbon content (to give minimum carbon deposition in the motor), and (4) should flow sufficiently freely at low temperatures to permit adequate lubrication under extreme conditions. With present refining methods it has not been possible to meet all of these requirements in a single oil, even from the best crude oils available.

A considerable amount of work has been done to determine whether by the use of the hydrogenation process, all of the above characteristics may be combined in a single oil. In general, hydrogenated paraffinic lubricating oils with a flat temperature-viscosity relationship are characterized by unusually high flash points and low Conradson carbon content. The high quality of these hydrogenated lubricating oils predicable from the laboratory inspection has been substantiated in actual engine tests. In view of the possibilities of producing essentially the same premium quality lubricating oils from a wide variety of inferior lubricating distillates, it would seem that hydrogenation will have an important influence in this field of refining in the future.

It has been found that by hydrogenation it is possible to make marked improvement in a number of inferior quality lubricating distillates. Under the best conditions for this type of hydrogenation there is produced from 100 barrels of lubricating distillate 103 to 104 barrels of hydrogenated product containing from 60 to 85 barrels of lube oil, somewhat lower in viscosity but much more paraffinic than the charge, together with about 10 barrels of gasoline and from 10 to 30 barrels of gas-oil. About 80-90 per cent of the sulfur in the feed stock is eliminated during hydrogenation.

Figures 2, 3, and 5 give yield charts showing the products obtained using various charging stocks.

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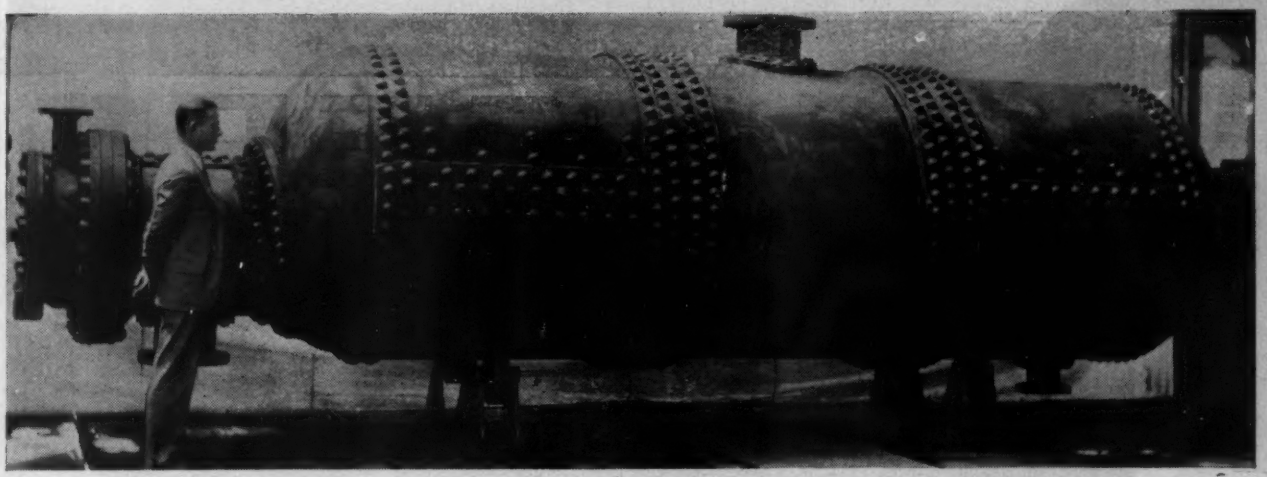

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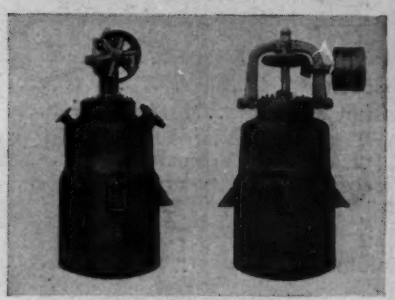

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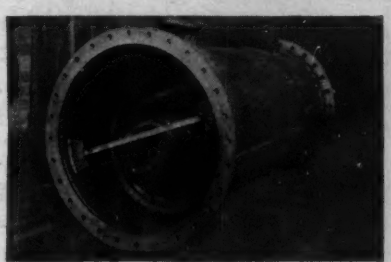

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TABLE III.

RESULTS OF HYDROGENATING VARIOUS BURNING OIL DISTILLATES

FEED STOCK	Low grade Mid.Continent	Low-grade Mid.Continent	Alematos (Cal.)	Long Beach (Cal.))	West Texas Light Gas Oil	Cracking Coil Distillate	Colombia	Cracked Mid.Continent	West Texas Diesel Fuel
Gravity, °A.P.I.	40.2	41.1	36.4	36.8	35.3	39.0	36.1	39.7	30.5
Viscosity*	485	480	750	750	705	335	600	400	595
Sulfur, per cent	0.221	0.285	0.550	0.240	0.761	0.157	0.202	0.334	0.487
Per Cent "400" Viscosity Oil** in original	58	90	38	40	30	100	30	100	40
A.P.I. of "400" Viscosity Oil	41.2	40.0	40.0	39.9	39.1	39.0	38.9	39.7	35.1
Viscosity* of "400" Viscosity Oil	400	450	380	400	410	335	400	400	400
Results of Hydrogenation									
Volumetric Recovery***	106	100	106	99	102	100	101	103	105
A.P.I. of Total Product	48.9	52.1	46.0	45.6	54.2	45.8	51.6	47.2	51.0
Per cent Sulfur of Total Product	0.006	0.011	0.022	0.025	0.026	0.024	0.029	0.014	0.019
Per cent "400" Viscosity Oil in Total Product	83	75	65	60	58	85	73	80	65
A.P.I. of "400" Viscosity Fraction	46.0	46.7	43.0	43.3	45.5	43.8	44.1	44.4	44.0
Viscosity* of "400" Viscosity Fraction	415	380	410	400	375	335	355	360	360
Sulfur per cent	0.007	0.012	0.013	0.012	0.018	0.022	0.013	0.025	0.015
Flash °F. (Abel)	107	100	122	120	109	128	104	106	115
Color (Saybolt)	22	25	17	25	25	25	18	25	...
Per cent Sulfur Elimination	97	96	96	90	97	85	86	96	96
Improvement in A.P.I. of "400" Viscosity Fraction	4.8	6.7	3.0	3.4	6.4	4.8	5.2	4.7	8.9

*Saybolt Thermo. Refined Oil viscosity @ 60° F.

**The term "400" Viscosity oil is used to denote the fraction of about 400 viscosity and about 100° F. Abel flash. As will be noted the true viscosity of most of the cuts actually made was slightly above or slightly below 400.

***Not including a small yield of recovery naphtha produced concurrently.

tillates and poor quality light gas oils may be hydrogenated to produce high yields of water-white distillates and burning oils of high quality. In general these products meet specifications as to sulfur, color, and smoke tendency with no other treatment than reduction to flash and viscosity.

In this adaptation of hydrogenation it has been found desirable to start with a stock somewhat more viscous than the desired finished oil, with the result that in many cases the actual yield of finished high grade burning oil has been greater than the amount of low-grade material of kerosene boiling range and viscosity originally present in the charging stock. Liquid yields are from 100 per cent to 105 per cent by volume and the product from 65 per cent to 85 per cent of high grade burning oil, the remainder being a gasoline. This is shown for a typical case in Figure 6.

A survey of a number of feed stocks has shown that burning oils at least equal to those obtained from straight run Mid-Continent or Pennsylvania distillates may be obtained from such stocks as California, Coastal, heavy distillates from cracked Mid-Continent gas oils and a number of others. Table III shows a comparison of the results obtained with various feed stocks.

In Table III the quality of the burning oils produced may be judged by the gravity of the "400" refined oil viscosity oil produced, this generalization having been proven by numerous lamp tests. Thus a cut of 400 viscosity and 42 A. P. I. gravity would give a burning test about equivalent to that of a 400 viscosity cut from Mid-Continent crude, and a cut of 400 viscosity of 45 to 46 A. P. I. gravity would be equivalent to a Pennsylvania fraction of the same viscosity. All the hydrogenated burning oils have been found to be very stable.

The following points are worthy of note in Table III:

(1) The sulfur elimination is from 85 to 90 per cent of the total despite the wide variety of sulfur forms encountered in the different stocks used. On a large scale 99½ per cent of sulfur has been eliminated from a West Texas gas-oil.

(2) Charging stocks of from 450 to 600 viscosity usually give the best yields (75 to 85 per cent) of 400 viscosity finished refined oil.

(3) In contradistinction to other methods of burning oil improvement now available, none of the charge is degraded. The entire hydrogenated product consists of burning oil and gasoline, both of which are more valuable than the charging stock. In other words, hydrogenation actually reconstructs the undesirable constituents present in the feed rather than separating them out by some such method as solvent extraction.

(4) All the stocks, although differing widely in initial chemical characteristics, after hydrogenation equal the very highest A. P. I. gravity natural burning oils in physical characteristics. Analysis indicates that by hydrogenation (a) olefines are almost completely eliminated, (b) the greater portion of the

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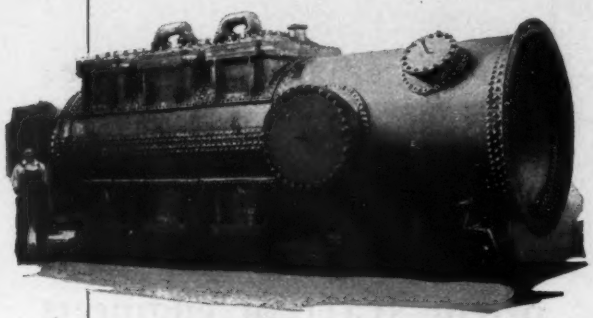

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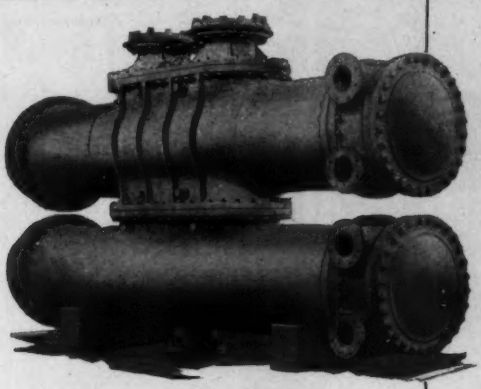

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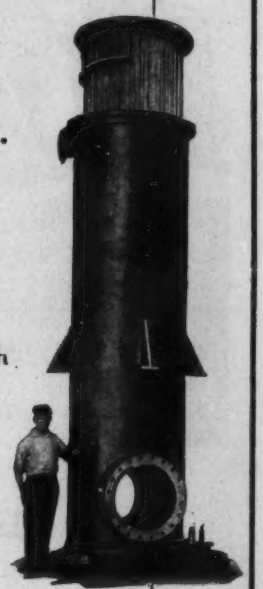

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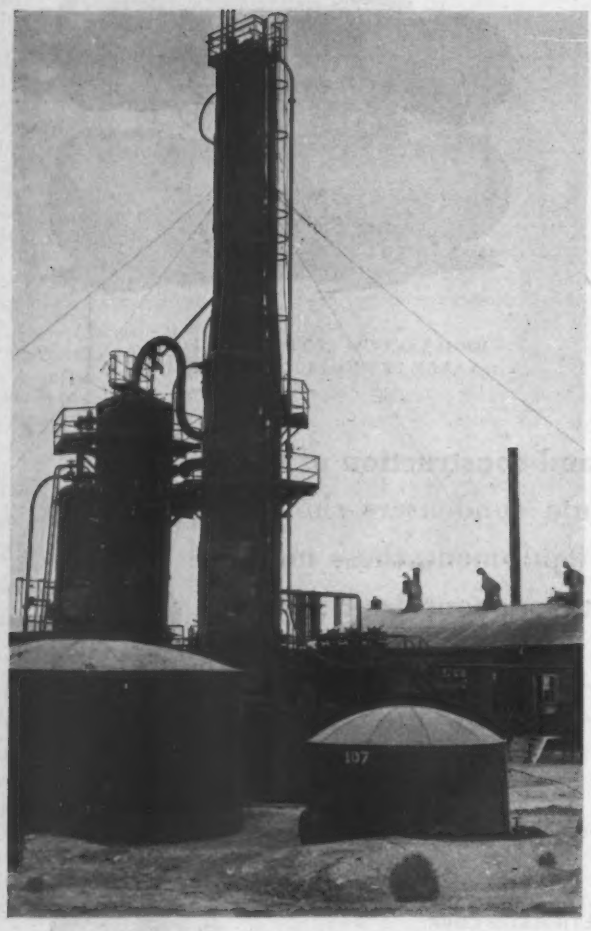

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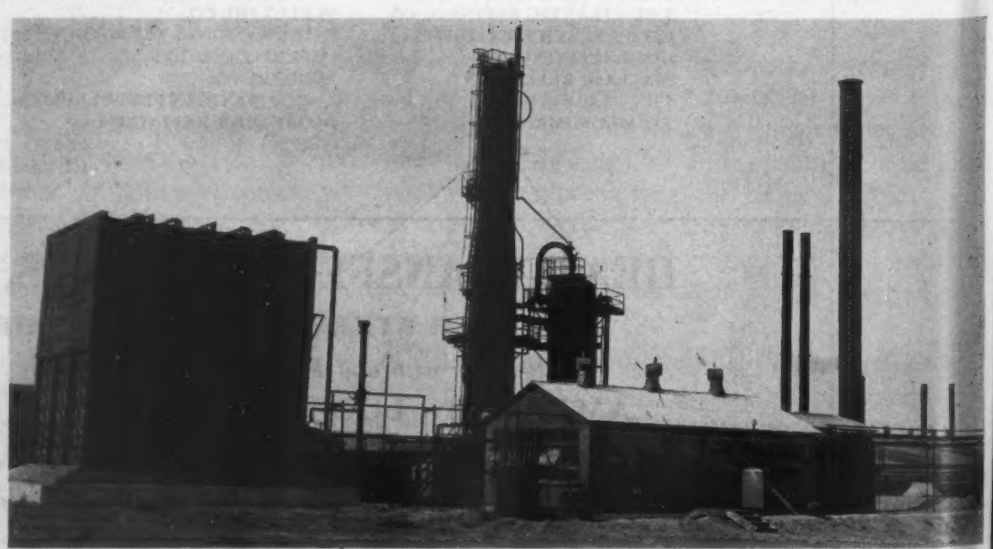

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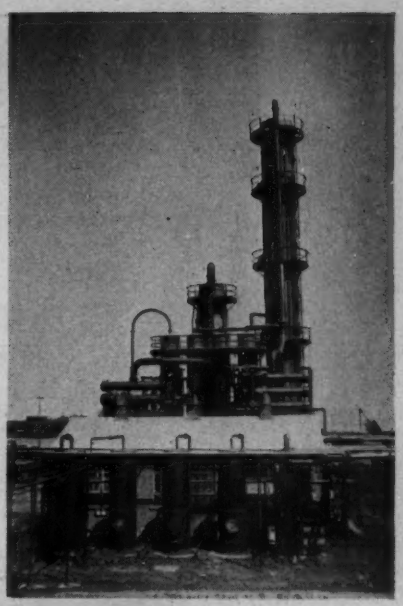

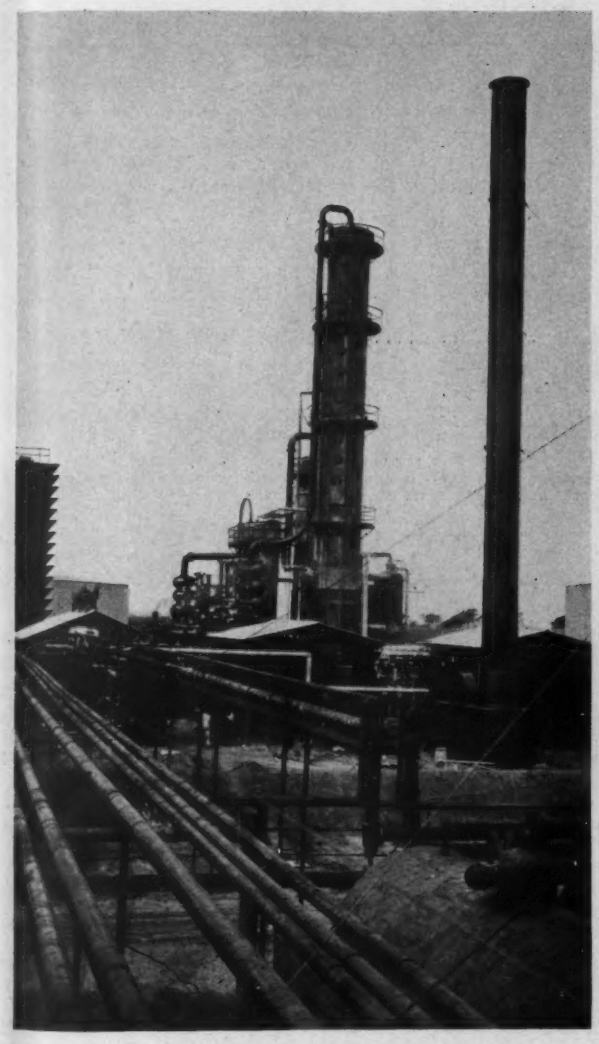

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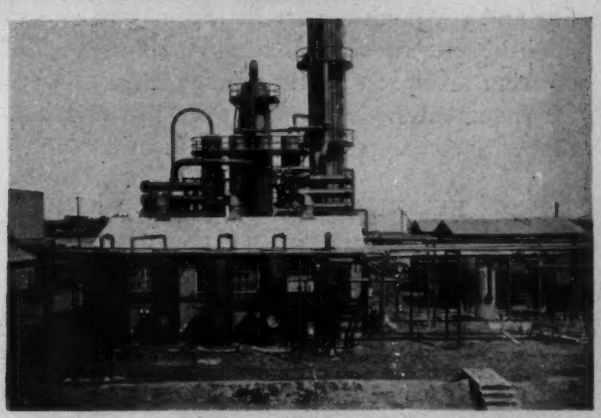

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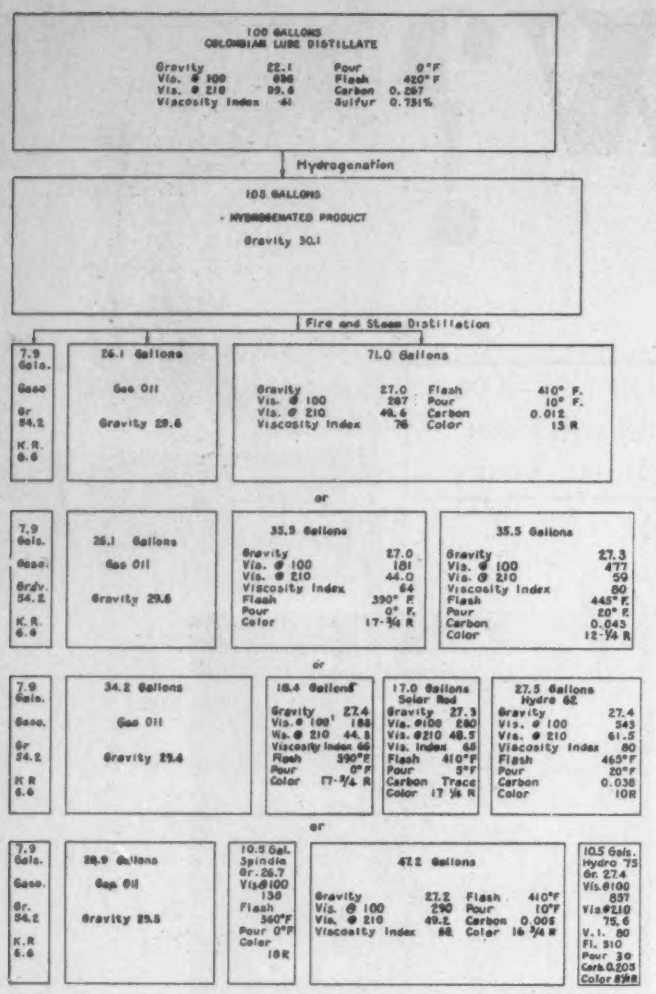


FIGURE 5

aromatics are converted into naphthenes and paraffins and (c) there is very little apparent effect on the naphthenes, probably since new naphthenes are formed from aromatics in the charge, thus offsetting the improvement brought about as the original naphthenes are changed into more paraffinic compounds.

ELIMINATION OF SULFUR AND GUMMING TENDENCY

In view of the remarkable facility with which catalytic hydrogenation eliminates sulfur, this process has been used for the treatment of natural or cracked naphthas. By a mild hydrogenation a high-sulfur, high-gum and unstable gasoline may be rendered stable, with about 50 per cent of the sulfur eliminated under such conditions of operation that the anti-knock value is lowered only to about the same extent as would result from a slight chemical treatment. This phase of the process would be carried out in such a way that no appreciable change would be made in the boiling range of the naphtha. The process may also be so operated as to almost entirely eliminate sulfur from a high-sulfur, cracked naphtha, with a small increase and in some cases an actual decrease in knocking tendency. Depending upon conditions of operation, this treatment eliminates from 65 per cent to 98 per cent of the sulfur in the feed stock and gives a gum and color stable naphtha which, after a light wash with caustic soda, passes corrosion and doctor tests. The following tables show character of stock charged and finished product. Improvement in color, gum and sulfur is readily apparent.

TABLE IV.

Finishing of Cracked Smackover Naphtha by Hydrogenation

Total Product	Charge: Cracked Smackover Naphtha	Hydrogenated Product: 100 per cent Yield
Gravity (A.P.I.)	46.4°	51.9°
Sulfur	0.395 per cent	0.019 per cent
Doctor	Does not pass	Passes
Color	Straw	+25 Saybolt
I. B. P.	124°F.	134°F.*
Per cent at 212°F.....	14.5	12.0
Per cent at 302°F.....	40.5	45.0
Per cent at 374°F.....	64.0	73.5
Per cent at 400°F.....	71.5	82.0
F. B. P.	540°F.	502°F.
Gasoline		
Gravity (A.P.I.)	53.9	55.3
Sulfur	0.188 per cent	0.006 per cent
Porcelain Dish Gum ...	12 mgs.	1 mgs.
Copper Dish Gum	21 mgs.	4 mgs.

*The change in initial boiling point is due to not fully recovering the low boiling fractions from the recycle gases.

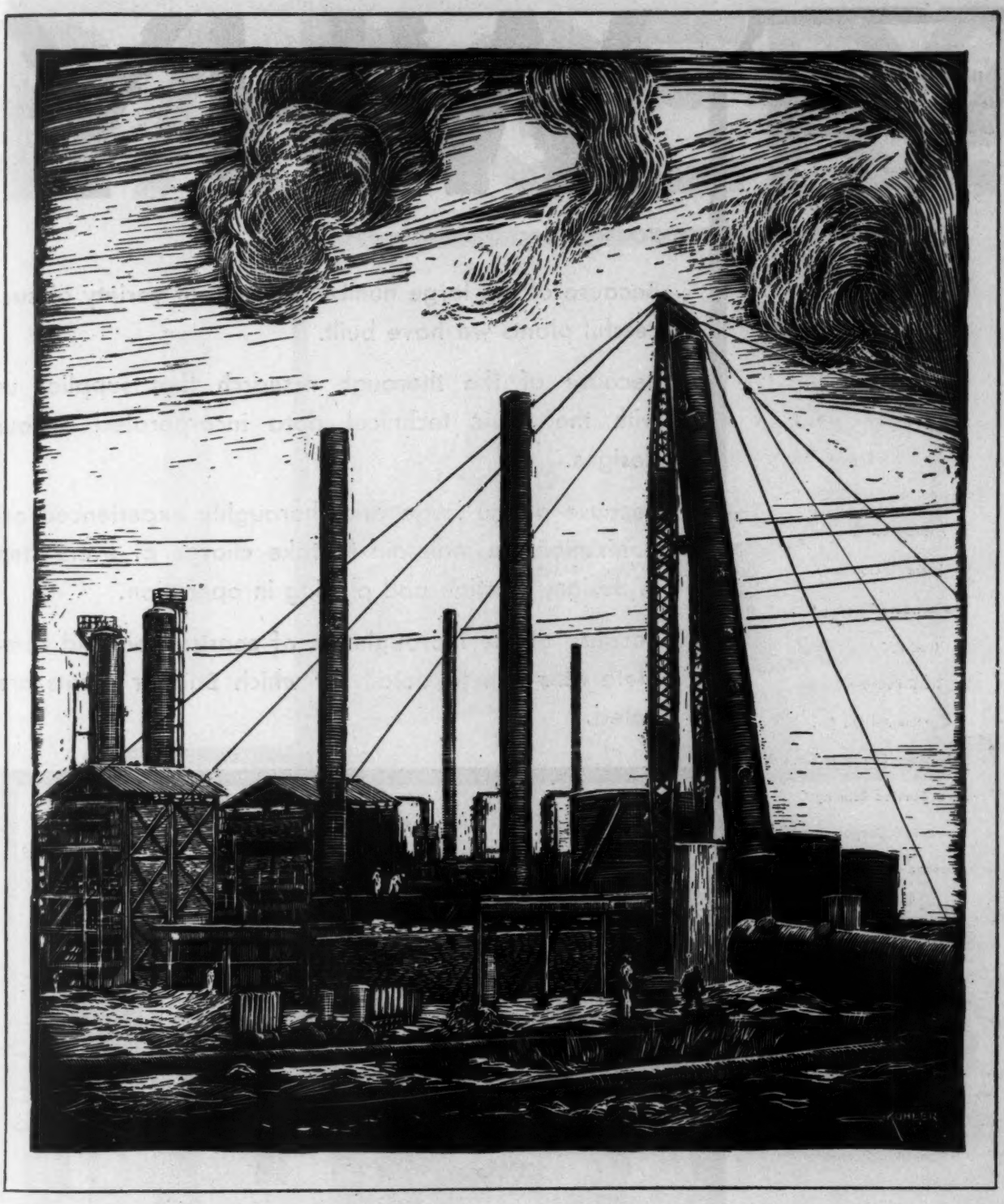
TABLE V

Finishing of Cracked Mid-Continent Naphtha by Hydrogenation

	Feed Cracked Naphtha	Aicd Treated 7 lb. 98 Acid barrel	Hydrogenation No. 1	Hydrogenation No. 2
Per cent 400 F.B.P. gasoline based on feed..	71.5	64.2	65.4	65.7
Gravity (A.P.I.)	53.9	53.1	56.1	44.3
Sulfur, per cent	0.39	0.15	0.15	0.02
Porcelain dish gum (mgs.)	12	8	3	3
Accelerated gum (mgs.)	51	37	3	4
Anti-knock value as per cent iso-octane in n-heptane	65.3	62.2	63.8	78.0

STABLE LOW-KNOCK GASOLINES

The production of stable low-knock gasolines by hydrogenation, although carried out in the same equipment as those modifications described earlier, differs from them considerably in both aims and results. For example, in converting a fuel oil into gasoline and gas oil, or in up-grading a lubricating oil or refined oil distillate, hydrogen is added to materials naturally deficient in this respect. In other words, hydrogenation has served to saturate the hydrocarbon molecule and to render it more paraffinic. By suitably changing the operating conditions, but still utilizing the same equipment, the process may be reversed to yield stable, but non-paraffinic products. Thus, in one run on the hydrogenation pilot plant at Baton Rouge, using a Mid-Continent gas oil as charging stock, the first product made was a paraffinic burning oil of high gravity; without stopping operation, and merely by changing the conditions, the same charging stock yielded over 85 per cent of



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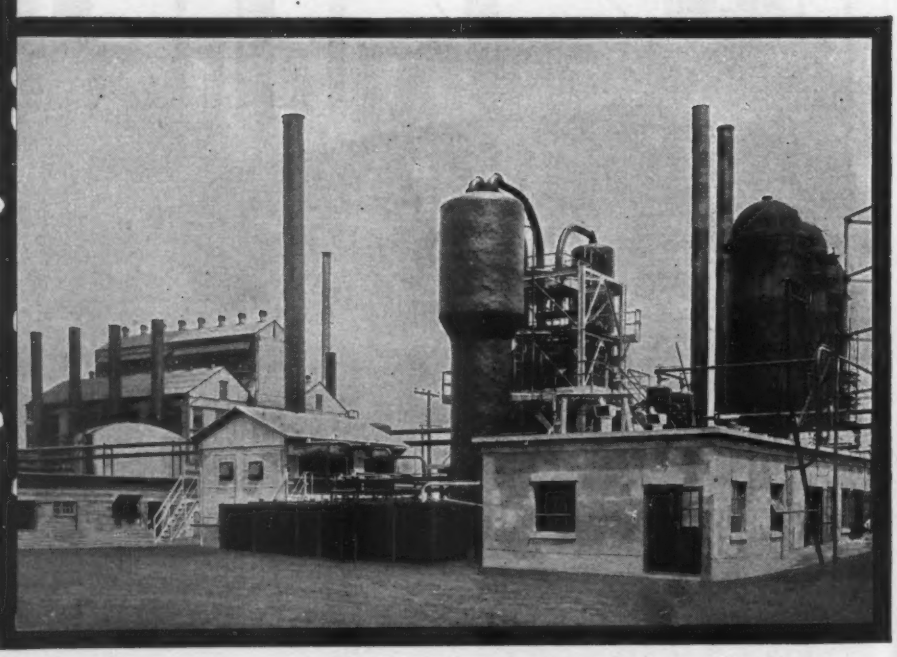

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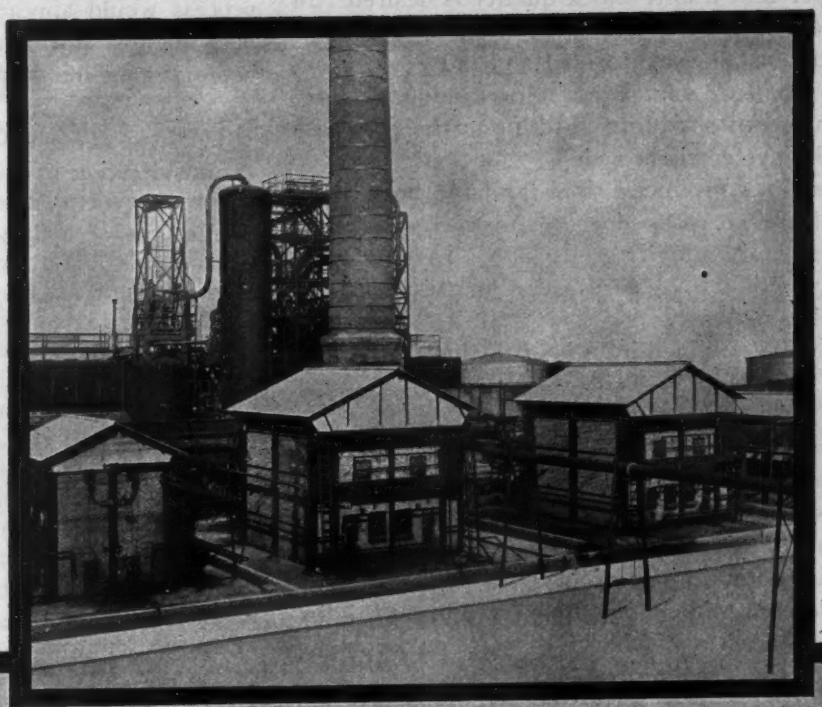

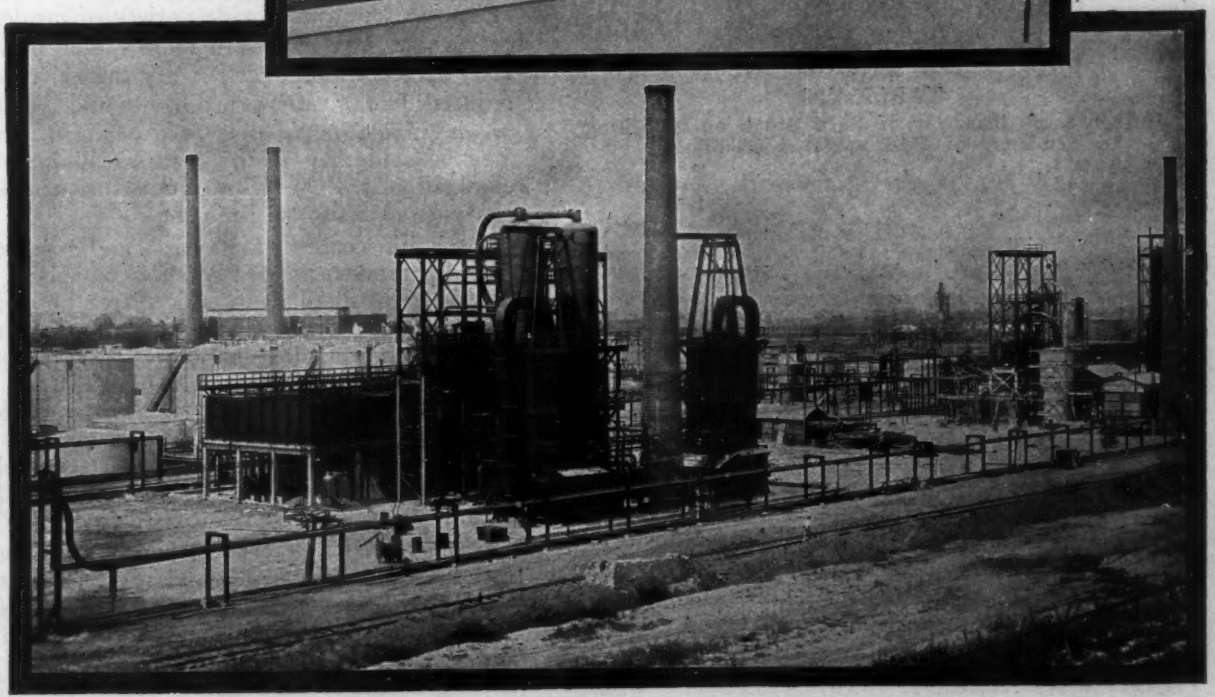

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a stable, low-sulfur gasoline having the same knocking tendency as 72.6 per cent of iso-octane in n-heptane.

It will be recalled that in those adaptations of hydrogenation described earlier the volumetric yield is 100 per cent or more. This is not the case in producing gasoline from gas oil, unless the knocking tendency is immaterial, the yield of gasoline being less than 100 per cent if anti-knock quality is desired. In making anti-knock gasoline by hydrogenation, however, no tar or coke are formed and only two products are obtained; namely, gasoline and gas. Any material not converted into gasoline in the first pass through the system is recycled.

The gasolines produced thus far have been practically sulfur-free, pass doctor and corrosion after lye-washing and are quite gum stable; in a few cases some treating has been necessary, but this has been very small in amount.

Some results obtained by this operation using light gas oils* are given in Table VI, which shows the properties of both the feed stock and product. It will be noted that better knock-ratings are obtained with more favorable stocks: i. e., with less paraffinic charging stocks it is possible to obtain higher yields of gasoline of given knock-rating, or much better knock ratings for a given yield.

The following table shows quite strikingly this influence of character of charging stock on knocking tendency of the gasoline produced. Thus:

TABLE VII

Influence of Character of Feed Stock on Knocking Tendency of Hydrogenated Gasolines

Gasoline yield	89.9	91.4	88.0	89.0
Aniline point of charge stock	161	139	102	79
General characteristics of charge	Highly paraffinic	Medium paraffinic	Medium aromatic	Highly aromatic
Knock rating as per cent iso-octane in n-heptane	72.6	75.3	85.0	86.2

TABLE VI

Production of Anti-Knock Gasolines by Hydrogenation

Feed Stock	Mid-Continent Light Gas Oil		West Texas Cycle Gas Oil	
A.P.I.	37.4		30.3	
Initial	474		400	
Per cent at 460	2.5		56.0	
Per cent at 550	89.0		...	
Per cent at 650	...		...	
Per cent at 700 or F.B.P....	618		612	
Sulfur	0.153		0.192	
Aniline point	161		102	
Hydrogenated Product				
Yield, per cent by vol.....	89.9	94.5	88.0	
A.P.I.	55.4	39.8	42.3	
Initial	95	110	109	
Per cent at 212	35.0	13.5	12.0	
Per cent at 284	54.0	25.0	32.5	
Per cent at 356	72.5	...	...	
Per cent at 374	79.0	50.5	70.5	
Per cent at 400.....	87.0	70.5	90% at 392	
F. B. P.	428	436	412	
Knock Rating as per cent iso-octane in n-heptane..	72.6	82.2	85.0	
Dissolved gum	17.7	9.0	...	
Sulfur	0.013	0.005	0.006	

*This adaptation of hydrogenation has thus far been applied mainly on gas oils having final boiling points of 650 degrees F. or under although some stocks with 40 per cent or more boiling above this temperature have been found susceptible to this type of treatment. An investigation is now in progress to determine quantatively the influence of end-point and boiling range on the results obtained.

The potential value of these highly anti-knock gasolines as blending agents is readily apparent, and many interesting combinations with cracking have been developed by experimentation,, e.g., gas oils, to (a) increase gasoline yield (b) decrease refinery fuel oil production and (c) markedly better the knocking characteristics of the refineries' entire gasoline output.

The application of this phase of the hydrogenation process would appear to be wide, particularly as the need for low sulfur, good knock-rating, stable gasoline becomes even more pronounced.

CONCLUSIONS

Consideration of the above illustrations leads to the following generalizations regarding hydrogenation:

The type of hydrogenation employed in treating petroleum oils differs materially in all the major aspects from hydrogenation of the Sabatier type in that (a) hydrogen at high pressure is used, (b) the hydrogen is relatively impure and contains hydrogen sulfide, (c) the catalysts are sulfur resistant, and (d) relatively higher temperatures are employed.

Long time runs of six to eight months on commercial apparatus at high temperature may be made without coke or tar formation. The 90 per cent point or the final boiling point of the product throughout the run may be less than that of the charging stock.

Sulfur, an ever mounting problem in the oil industry, is readily eliminated. This holds true for all the forms of sulfur found in a wide variety of crudes. In a recent vapor phase operation on a unit producing over 2500 barrels of product per day the sulfur content was reduced from 0.708 per cent to under 0.01 per cent, or an elimination of over 98.5 per cent. In general it may be said that when operating in liquid phase the elimination will be 60 to 75 per cent and in vapor phase from 80 to 99 per cent.

Asphaltic crudes of all sorts and residues from refractory crudes, as well as cracking plant tars can be converted to distillate products free from asphalt and low in sulfur with volumetric yields in excess of 100 per cent. The hydrogenation process, therefore, offers the oil industry (a) a means of confining its production of heavy fuel to its economic market demand, and (b) a means of balancing crude production against the demand for refined white products, gasoline, Diesel fuels, burning oils and the like, independent of the natural, heavy fuel content of the crude.

From mixed base crudes, highly paraffinic products such as gas oils, burning oils and lubricants may be produced. On the other hand, from paraffinic crudes so-called aromatic products may be formed as for example, a highly anti-knock gasoline from a very paraffinic gas oil. Even from the same gas oil paraffinic burning oil and anti-knock gasoline may be made. Consequently from any given supply of crude the products of the quality desired may be produced by refineries employing hydrogenation.

PROCESS FLEXIBLE

The flexibility of the process is very marked as to character of the charging stock and quality of product produced. Examples have been given showing how the same plant may be used (a) for producing gasoline and gas oil, (b) very paraffinic high A. P. I. gravity

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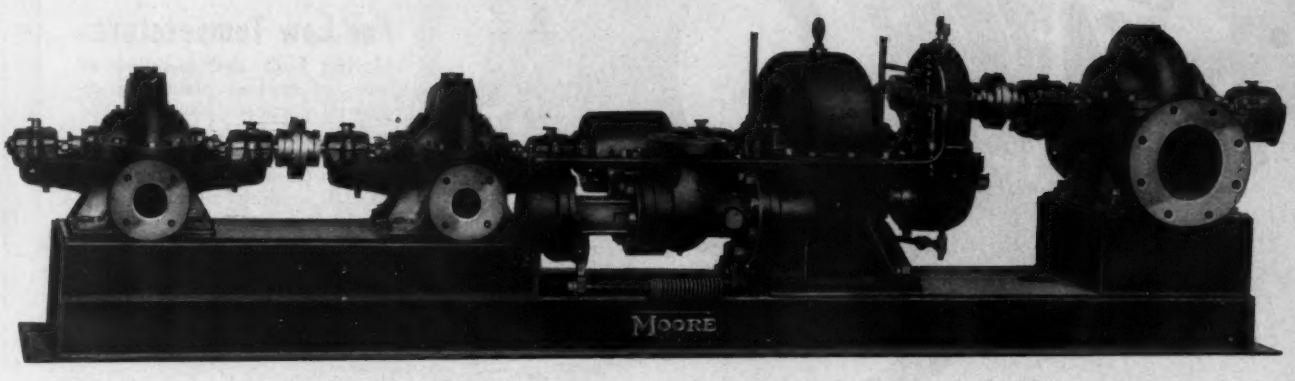

The low steam consumption of the unit illustrated above is made possible by the use of the Moore combined turbine and reduction gear.

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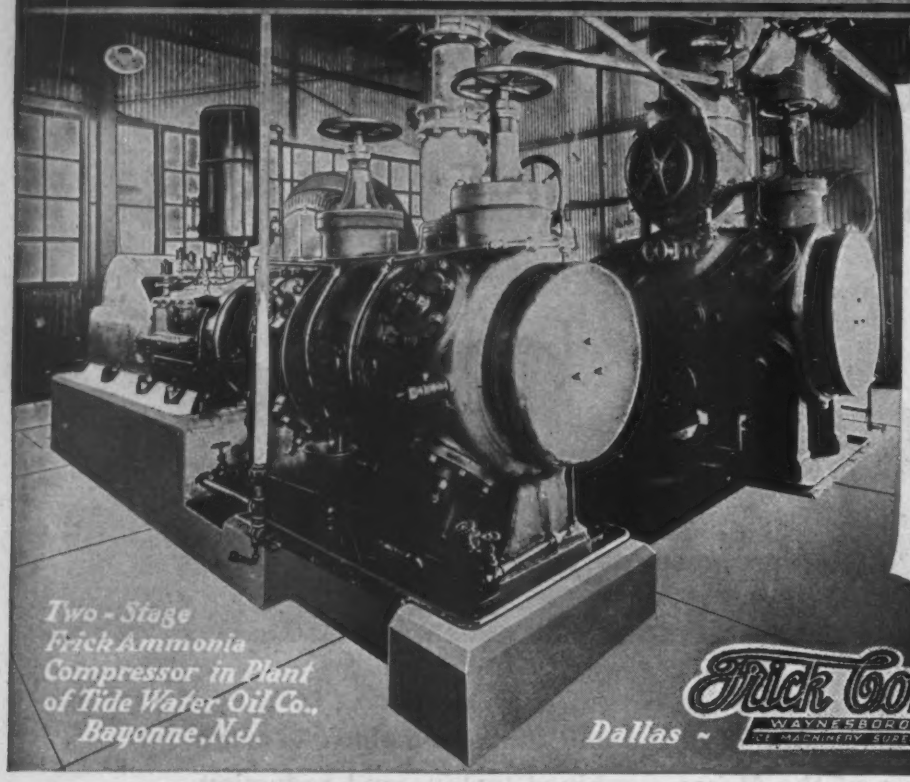

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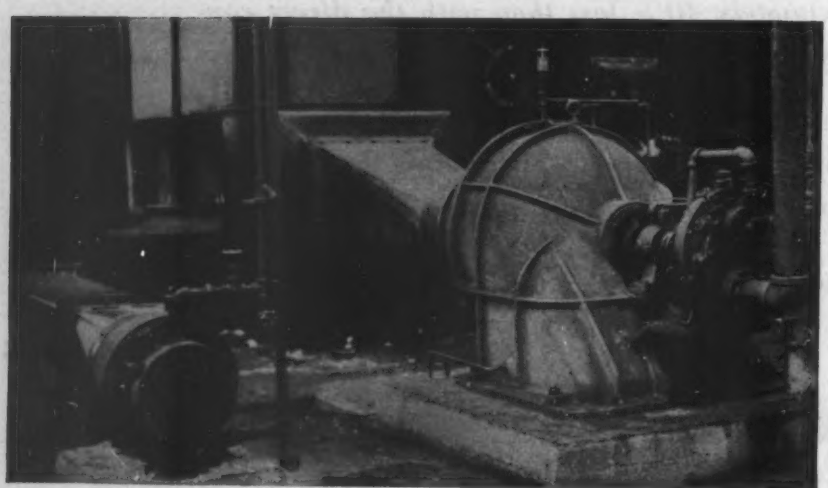

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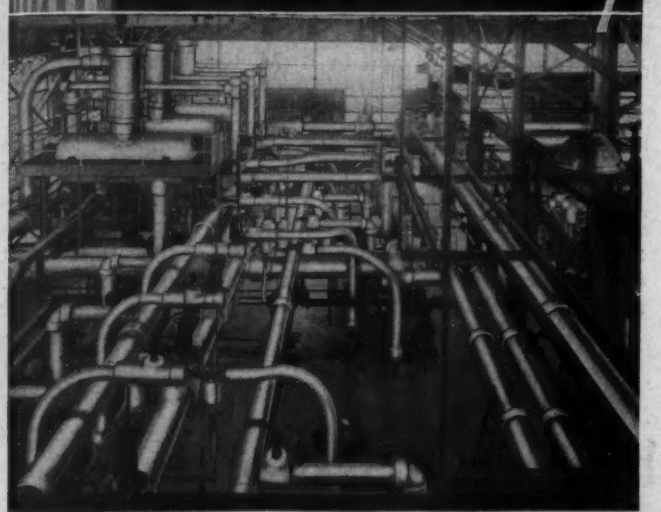

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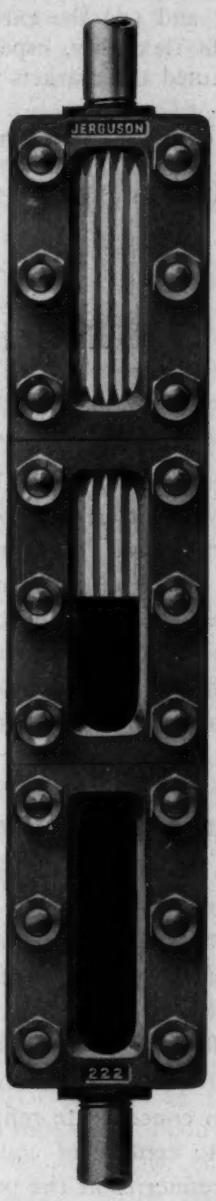

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burning oils from mixed base gas oils, (c) color and gum stabilizing and desulfurizing highly cracked naphthas, (d) production of paraffinic lubricants from mixed base stocks and (e) production of anti-knock, high compression gasoline from paraffinic gas oils. Further, from the above examples it may be seen that from practically any grade of crude oil products of any desired quality may be produced.

The hydrogenation process used compressed hydrogen, a rather costly material. Offsetting this are the following factors: (a) the ability to balance crude run to white product demand, (b) the premium quality of products produced, (c) the low value charging stocks that may be used, and (d) the extreme utility of the process, due to its flexibility, especially where types of crudes to be refined and markets to be supplied vary from time to time.

Because of the over supply of crude oil, hydrogenation in its present state of development may be considered as supplementary to present refining methods. It probably will supplant them as the supply of crude oil and demand for light products approach a balance.

ACKNOWLEDGEMENT

In presenting this paper the authors wish to take this opportunity of acknowledging their indebtedness to many of their associates, but particularly to the entire staff of the high pressure research laboratory at Baton Rouge, especially Messrs. W. C. Asbury, M. W. Boyer, P. J. Byrne, Jr., G. H. B. Davis, W. V. Hanks and J. M. Jennings, and to E. M. Clark, president, and F. A. Howard, vice president, of Standard Oil Development Company.

Since the original research and development of high pressure hydrogenation of coal and oil has been one of the most if not the most costly process developments ever undertaken, the authors wish to express their respect for and admiration of the two corporations most directly responsible, the I. G. Farbenindustrie A. G. and Standard Oil Company of New Jersey, and their respective presidents, Dr. Carl Bosch and W. C. Teagle.

Oil Refining in the Soviet Union

(*Continued from page* 81)

is set at 12,000,000 tons, 12 times the output in 1928-29. The increase in output is to be obtained mainly by means of an extensive development of the cracking process. It is likewise planned to run an increasing percentage of the crude oil through the refineries. While in 1927-28 this percentage was only 75 per cent, in 1930-31 it is expected to reach 95 per cent, and in the last year of the five-year period close to 100 per cent.

INCREASES 30 PER CENT ANNUALLY

The expanded program for total oil output calls for an annual increase of over 30 per cent. The revised plan for 1930-31 calls for a total production of 23,000,000 tons, of which refined products are to constitute about 21,000,000 tons; and that for 1932-33 for a total of 42,000,000 tons, of which practically all is planned to be run through the refineries.

It is planned to concentrate refining operations in close proximity to centers of consumption and export. Thus the refineries at the ports of Batum and Tuapse will be enlarged more and more, so that by 1932-33 they should dispose of 35 per cent of the total refined products. Foreign markets demand primarily gasoline and the higher-class products; consequently at Batum and Tuapse there are being constructed installations for cracking and the complete treatment of crude oil.

The domestic market, on the contrary, demands at present chiefly kerosene and mazut, though the demand for gasoline is expected to exceed the latter by the end of the five-year period. To meet the domestic demand it is proposed to construct a crude oil pipeline from the Caspian Sea to Moscow, where over 1,500,000 tons of the heavy oil from Baku will be treated annually in a refinery to be constructed in Moscow. Another refinery is to be established at Samara for the treatment of about 650,000 tons annually of crude oil from the Emba fields. This plant will supply refined products to the Volga basin, the Ural district, and Siberia.

Thus the majority of new refineries will be established at the centers of exportation, and their main product will be gasoline, obtained chiefly by the cracking process. The manufacture and export of lubricating oils of all varieties and compound greases will also be increased.

As a result of improved refining facilities production of oil products hitherto manufactured in small quantities, or not at all (such as paraffin, petroleum asphalt, bright stocks, lamp black, vaseline, coke, etc) is already being developed and is expected to record considerable increase by the end of the five-year period.

The Hydrogenation of Mineral Oils*

By I. N. BEALL
Chemical Engineer

IT is customary to rate the efficiency of a chemical process upon theoretically calculated yields, even though such yields are not attainable under actual conditions. This method of rating efficiency establishes a sound basis for calculation, and is an excellent means for comparison of results. For example in the reaction $C_2H_4 + H_2 \rightarrow C_2H_6$, the molecular weight of ethylene is 28, that of hydrogen two, and that of ethane 30. If two pounds of hydrogen could be added to 28 pounds of ethylene to produce 30 pounds of ethane, the efficiency of the process would be 100 per cent based on both constituents. If the reaction required 28 pounds of ethylene and four pounds of hygrogen to produce 30 pounds of ethane, the efficiency of ethane production based on ethylene would still be 100 per cent. Based on hydrogen, the efficiency would be 50 per cent.

BASIS OF CALCULATIONS

It has been customary to rate the efficiency of cracking processes upon a volumetric basis, that is, if 100 gallons of cracking stock yielded 75 gallons of gasoline, the efficiency was 75 per cent gasoline based upon charging stock. Such efficiency rating is justified by the fact that crude oil is bought and gasoline sold by volume rather than weight. The scientific method of computing chemical process efficiency is strictly upon a weight basis, as this greatly simplifies calculations because of the constancy of mass regardless of form. The purchaser of a barrel of 15° Be. crude gets more pounds of oil than the purchaser of a barrel of 40° Be. crude; to be exact, 49.3 pounds more for heavy than for light.

Now let it be assumed that there can be obtained 70 gallons of 60° Be. gasoline from each 100 gallons of both heavy and light crude; the volumetric efficiency in each case will be 70 per cent. This is not so, however, on a weight basis—as:

70 gallons of 60° Be. gasoline=430.57 pounds.
100 gallons of 15° Be. crude=804.4 pounds.
100 gallons of 40° Be. crude=687.0 pounds.
Efficiency on weight basis:
$(430.57 \times 100) \div 804.4 = 53.53$ per cent for 15° Be. oil
$(430.57 \times 100) \div 687.0 = 62.8$ per cent for 40° Be. oil

Assume the possibility of 100 per cent conversion of crude stock into gasoline of the above gravity on a weight basis, the volumetric efficiencies would be:

$$\frac{804.4}{615.1} \times 100 = 130.8 \text{ per cent for } 15° \text{ Be. stock}$$

$$\frac{687.0}{615.1} \times 100 = 111.7 \text{ per cent for } 40° \text{ Be. stock}$$

The above calculations will serve to show the superiority of any conversion process which can efficiently transform heavy oil into light gasoline on a weight basis. This is the objective of hydrogenation—the theoretical calculations given in the foregoing illustrations are not the theoretically maximum yields attainable by hydrogenation on an oil basis as to this must be added the weight of the hydrogen necessary to the reaction. This would further increase both gravimetric and volumetric yields of gasoline, the maximum theoretical yields would be for a chemically saturated product corresponding to the general formula C_nH_{2n+2}. Other factors remaining unchanged, higher volumetric efficiencies are possible for the higher Baume gasoline. Hydrogenation has possibilities for decreasing the price differential betwen light and heavy crudes.

MAXIMUM HYDROGEN CONVERSION

The lowest grade crude oils, as a rule, have the greatest hydrogen deficiency. Using the foregoing illustration for 15° Be. stock, 100 gallons of this crude would weigh 804.4 pounds of which probably 10 per cent or 80.44 pounds would be hydrogen in hydrocarbon form. Gasoline of 60° Be. would contain approximately 15.5 per cent of hydrogen by weight, therefore 52.4 pounds of hydrogen would have to be added to the crude to convert it into gasoline corresponding to the above empirical formula

$$\frac{15.50 \times (90 \times 804.4)}{84.5} - 804.4 = 52.4 \text{ pounds.}$$

The weight after combination with hydrogen would be $804.4 + 52.4 = 856.8$ pounds. By calculation on an oil basis the volumetric eficiency would be

$$\frac{856.8 \times 100}{6151} = 136.9 \text{ per cent.}$$

On a theoretical basis, the difference in yield with and without hydrogen addition would not com-

*This concludes a series of three articles by Mr. Beall on Hydrogenation.

pensate for the additional expense incident to its use as the net overall increased yield due to hydrogen is but 5.4 per cent. The great difference lies in the fact that by hydrogenation, the practical more closely approaches the theoretical yield, the laws governing equilibrium and mass action are immutable.

PERFECT OIL CONVERSION SYSTEM

There are two customary methods of comparison, one is based upon the absolute, the other upon the average. For the purposes of discussion, the absolute basis is used in the sciences as it permits of no variation. While the absolute may never be attained in actual practice, it nevertheless constitutes a solid foundation upon which to build, an example of which are laws of Boyle-Gay-Lussac, and Charles for perfect gases, although no such gases exist. A perfect oil conversion system therefore may be justifiably assumed and this will of necessity be arbitrarily defined.

The first broad requisite of the perfect oil conversion process would be that such a process be able to convert any given crude oil stock into motor fuel or other desired product pound for pound or 100 per cent on a weight basis. This would necessarily mean that among other things there would be no formation of carbon or fixed gas. The standard for operation would be that the process operate continuously without shutdown. The third criterion would be an economic one—the process that could convert the cheapest raw material into the largest percentage of highest quality finished product with the least expense would be considered as 100 per cent efficient. In the final analysis all other conditions are subordinate to the last assumption. Having now at least arbitrarily established a standard of comparison for oil conversion processes, an endeavor will be made to point out wherein all cracking processes have failed to meet the standards with the reasons therefor, and the remedies or palliatives that hydrogenation may have to offer. The major obstacles will be first considered.

Under the first requisite, cracking must of necessity fail because the laws of equilibrium demand that fixed gases rich in hydrogen be formed. This hydrogen must be sacrificed by the original stock, which in turn must sacrifice material rich in carbon, such as tar, coke, and carbon, if intermediate products such as gasoline which is relatively rich in hydrogen compared to the raw material to be formed. Under number two, the causes for shutdown other than for mechanical reasons, are due to the formation of coke; the reason for this is evident from the answer to number one.

While it is possible to crack any hydrocarbon oil into appreciable yields of gasoline, only certain stocks are economically practical. The low-priced, low gravity grades of crude of the asphalt base type, give low yields of motor fuel on cracking, tar and coke formation result in costly and time consuming shut-downs for clean-out and repairs. The total sales value of the products formed by cracking seldom justify their use for this purpose, as it is usually more economical to sell as low grade fuel oil. When run to gasoline and coke the yields of gasoline are comparatively low, coke yields are high as is also the quantity of fixed gas and operation is expensive. A cheap method for conversion to higher grade Diesel oil would have advantages, where approximately quantitative yields are possible. There is a growing demand for light Diesel and furnace oils. The greatest redeeming feature of all cracking processes is their simplicity of operation; this will continue to give such processes a place in industry. A consideration will now be given hydrogenation as a 100 per cent conversion process.

GET 100 PER CENT BY WEIGHT

Hydrogenation can not give 100 per cent weight yield of motor fuel on the amount of raw materials, although there are possibilities of more than 100 per cent by weight on the basis of oil consumed. It is to be remembered that hydrogenation in its broader sense is not limited to the simple expedient of supplying free hydrogen to a hydrogen deficient oil, but includes the addition of hydrogen in combined form, such as the unsaturated gases and partially oxidized hydrocarbons of higher hydrogen-carbon ration than the oil charging stock.

The monohydric alcohols and the ethers have the same ratio of hydrogen to carbon as the paraffin gases —the general formulas are $C_nH_{2n+2}O$ and C_nH_{2n+2} respectively. The aldehydes and ketones have the same ratio of hydrogen to carbon as the olefines,—the general formulas are $C_nH_{2n}O$ and C_nH_{2n}. The only difference is due to the oxygen in combination. The oxygen containing hydrocarbons are normally liquid instead of gaseous with the exception of formaldehyde. With the partially oxidized hydrocarbons it is possible theoretically to indefinitely build on to a crude oil stock as it is possible also to synthesize motor fuel direct from such compounds,—the so-called "synthol" or the "Patart" process is one example. One reaction among many others is arbitrarily written as follows $_nCO+3_nH_2=C_nH_{2n+2-n}H_2O$ although it mas as well have been written $_nCO + _nH_2 = C_nH_{2n+2}O + _nH_2O$ or $_nCO + _nH_2 = _nC_nH_{2n} + _nH_2O$ or $_nCO + _nH_2 \rightarrow C_nH_{2n}O$. For the formation of such a reaction mixture attention is called to the reaction $C_nH_{2n+2}+_nH_2O=_nCO+_nH_2O$ for example $CH_4+H_2O \rightleftarrows CO + 3H_2$ a typical water gas reaction.

The possibilities of hydrogenation of crude stock with such a mixture of carbon monoxide and hydrogen should be infinite and such a process would be flexible. Water-gas reactions are applicable to both refinery and cracking still fixed gases as well as to natural gas, and are convenient industrial methods for the production of hydrogen. The fact that the water gas from the reaction $C_nH_{2n+2}+_nH_2O \rightarrow _nCO + _nH_2$ contains carbon

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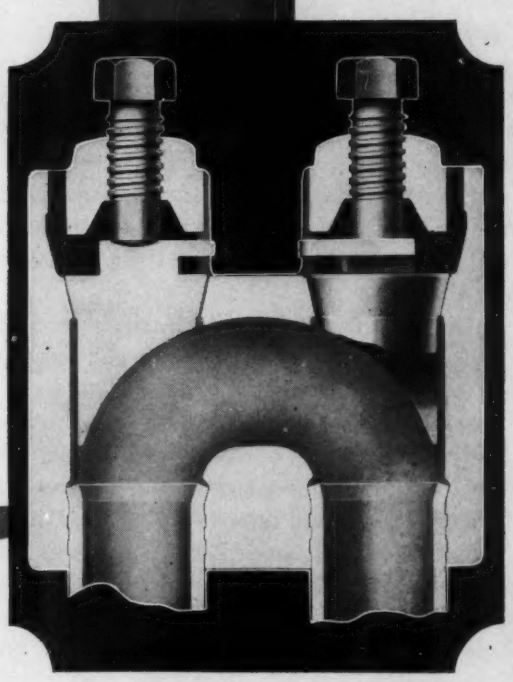

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monoxide, and methane does not militate against its use as a hydrogenating gas for crude oil stock, although for purposes of ammonia synthesis, the water gas is freed of carbon monoxide to form methanol $CO + 2H_2 \rightleftarrows CH_3OH$ the excess hydrogen being used for the reaction $n_2 + 3H_2 \rightarrow 2nH_3$. The methane residual is more difficult to cope with, although this is no particular disadvantage to oil hydrogenesis. Such water gas reactions require the use of a catalyst. The chrome zinc oxides are much used.

The use of hydrogen eliminates the formation of tars and coke if correctly applied. This is a decided economic advantage particularly when low grade crudes are used. Here specific attention is called to the observation of bone in regard to fuel combustion that the hydrocarbon addition products with oxygen on thermal decomposition deposit no carbon. The attraction of carbon and particularly nascent carbon for oxygen is so great, $2C + O_2 \rightarrow CO$, that it has the power of taking it away from the metallic oxides, such as iron. The addition of oxidized hydrocarbon would help to prevent the formation of carbon in a continuous high pressure system for oil hydrogenation. Hydrogenation also has great affinity for nascent carbon, forming hydrocarbons. It is therefore evident that two methods are applicable to the prevention of tar and coke in systems for hydrogenesis of oils. Hydrogenation increases flexibility of operation in many directions both from the standpoint of operating efficiency and fuel yield and quality.

The raw materials available for hydrogenation are low grade crude oils, residuums and materials unsuitable for cracking although the usual cracking stocks are not excluded. The raw materials for the production of hydrogen are waste refinery and cracking plant gases and natural gas and water (steam). The water gas reaction (modified form using a catalyst) has its application to oil hydrogenation as well as for ammonia synthesis.

The quality of the product will be determined by the method of operation,—it will be possible to produce gasolines of the saturated type or the other extreme which resembles the aromatic with all intermediate stages. Hydrogenation meets the economic requirements from both the basis of raw material and product. The initial plant cost will necessarily be high due to the use of high pressures, additional equipment for the generation, treatment, and compression of hydrogen, increased equipment for the more extensive reactions of hydrogenesis, which includes both synthesis and destructive pyrogenesis.

METHODS OF HYDROGENATION

The first gasolines used for internal combustion engines were prepared by straight distillation from Pennsylvania crude. These were naturally very volatile due to the small demand for such material required little or no chemical treatment and belonged predominantly to the paraffin or chemically saturated series. With the increasing demand for gasoline, new fields were developed and oils differing in character from paraffin base (Pennsylvania) were produced. The potential supply of materials suitable for the manufacture of motor fuel were further augmented by manufacture of motor fuel the advent of cracking processes of industrial size. For a number of years all but the motor fuels of the so-called saturated types were looked upon with disfavor, refiners sought to make their product conform to the requirements of Pennsylvania gasoline, by heavy treats of sulfuric acid to get rid of the "unsaturates." The losses as acid sludge by the treat were particularly heavy with "cracked" gasoline; hydrogenation among multifarious other proposed schemes were suggested, and various attempts made by investigators to reduce treating losses.

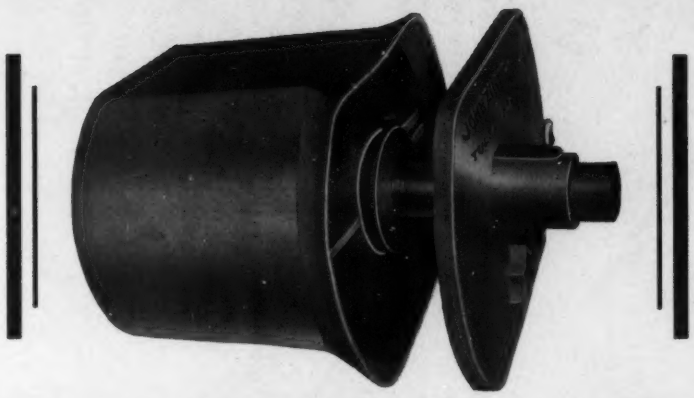
The problem of hydrogenation of unsaturates although theoretically simple on a purely addition basis proved rather difficult practically. The unsaturate, hexylene, for example, could be converted into saturate, hexane, by the introduction of two pounds of hydrogen to 84 pounds of hexylene. The addition of a surprisingly small amount by weight of hydrogen to a cracked gasoline would suffice to convert it to the saturated type, therefore the earlier attempts at hydrogenation were directed toward the treating of gasoline. Disregarding for the present discussion direct gasoline treating methods, cracking processes which have as their objective the production of more highly saturated motor fuels will be considered.

PROCESSES USING STEAM

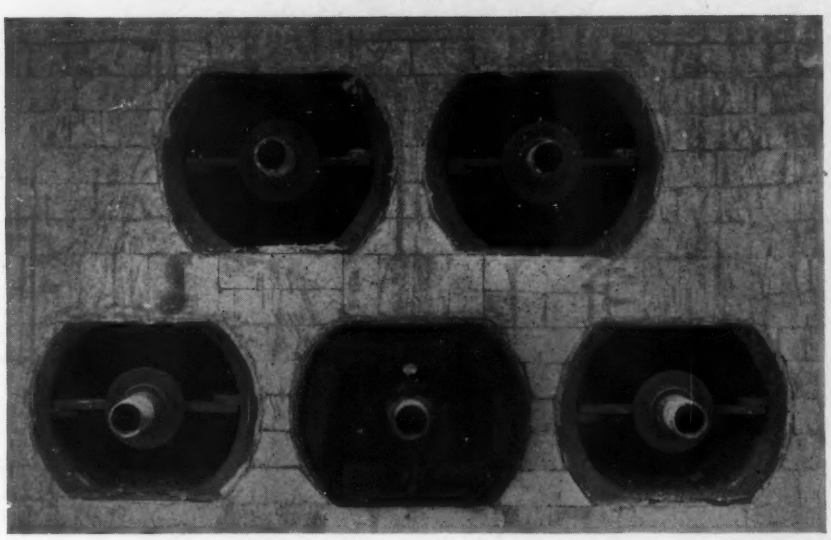
Water, as a source of hydrogen, early attracted the attention of investigators and many patent claims are made relative to its use as a hydrogenating agent for oil conversion. There was considerable justification for its attempted use, as the principles of the water gas reaction by passing steam through incandescent coke $C + H_2O \rightleftarrows CO + H_2$ had already wide industrial application as also had methods for the commercial production of hydrogen by the action of steam upon highly heated metals such as iron, $3Fe + 4H_2O \rightleftarrows Fe_3O_4 + 4H_2$.

It is to be remembered that high pressure technology was not until recently developed but it would be interesting to see the results from some of these processes under high pressure. The process of Dibdin and Wolterick (Brit. 19, 152, Sept. 25, 1901) for the production of illuminating and fuel gas is of interest. In this process steam and crude are subjected to high temperature of iron at substantially atmospheric pressure to form carbon monoxide and hydrogen, the iron simultaneously is converted to the oxide. Methane, ethane, ethylene, etc., are produced in the gas as a result of secondary reactions with excess of oil over steam above that required for the water gas reaction. The formation of fixed carbon is reduced by the use of mixed ferrous and ferric oxide as catalyst. As the temperatures used were 1600 to 2100°F. and the pressures low, the equilibrium was obviously toward the formation of hydrogen, fixed gases and carbon. Under

Heat Without Flame



Horizontal Bi-Mix Gas Burners



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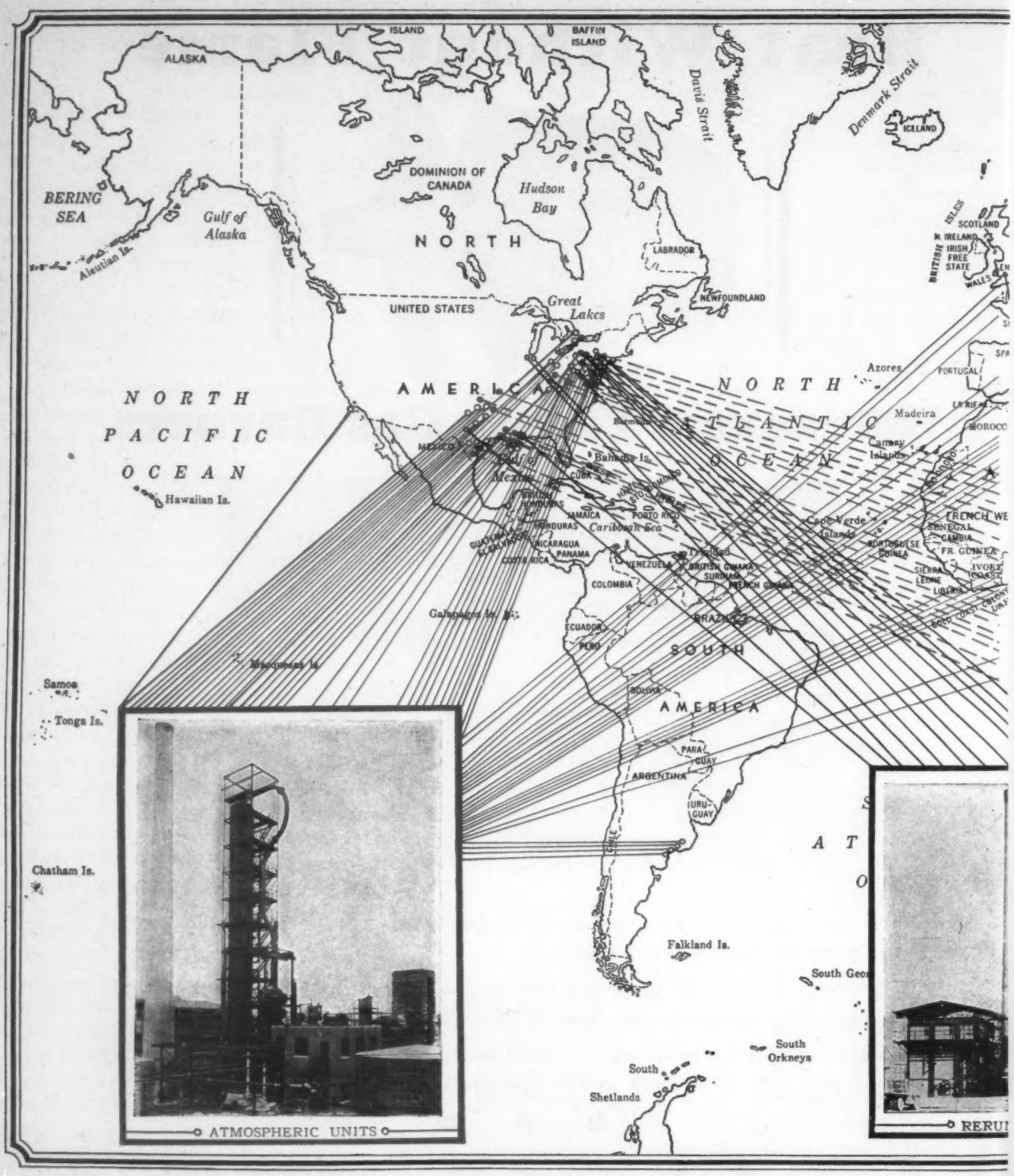

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such conditions the formation of metallic carbides would be difficult to avoid.

In 1913 H. Zerning passed mixtures of petroleum and steam through fire-clay-coated pipes through two zones of reaction, the first from 550 to 750°F. the second was at from 1500 to 1700°F. at sub-atmospheric pressure. Various products are mentioned as the result; it would be difficult to tell which might be attributed to straight thermal decomposition and which to the action of steam. The products evidently consisted of polymerized products and olefin gases together with hydrogen and carbon monoxide. (Jour., Soc. Chem. Ind. 1913, p. 781).

U. S. Patent No. 116,852, July 11, 1871 (Ellis & Meigs, Gasoline and Other Motor Fuels, P. 337) issued to Mengel and Von Pohrnoff describes a method by which heavy oil residuums are converted into as much as 87 per cent lamp oil by dropping liquid water upon the surface of oil while the temperature was between 600-800°F. If there could be any question as to the results obtained, there could not be doubt as to courage of conviction. There are many other processes using steam under various conditions of temperature, pressure and catalysis, the interesting observation is the consistency with which the water gas reaction is obtained.

Several investigators using steam refer to the desulfurizing action of nascent hydrogen at temperatures lower than those used for conversion by cracking. Hydrogen sulfide (H_2S) is one of the products of primary hydrogenation. The great disadvantage in the use of steam directly for purposes of hydrogenation is that the temperatures necessary for its decomposition into hydrogen and oxygen ($2H_2O \rightleftarrows 2H_2 + O$) are too high for the maximum yield of gasoline, and that no hydrogen is added to the system in excess of that required for the water. Where oxidizable metals are used, some of the oxygen is taken up to form the oxides which leaves more free hydrogen for hydrocarbon formation and the results, in such cases, are better. Finely emulsified oils containing finely divided metal such as iron might under high pressures and decomposition temperatures yield interesting results. The field needs to be reinvestigated using pressures comparable to those used for present methods of hydrogenation. Even with pressures as low as 100 to 200 pounds improved results and yields of motor fuel are noted by several investigators. Continuous methods are more suitable than batch processes for experimental work with steam and oil, as the chance of explosive vaporization is minimized by the small quantities in the system at any one time. With the present stage of development of high pressure, high temperature technique, there need be little to fear, if reasonable care is exercised. Synthesizing pressures just begin where these investigators left off, the use of pressure independent of temperature as an aid to synthesis has just begun to be realized commercially in its full significance. The decomposition of water gives hydrogen and oxygen, two of the most important constituents of all organic material, together with carbon, hundreds or thousands of synthetic compounds are possible. High pressure is the most powerful means so far devised for this purpose.

HYDROGENATION BY USE OF HYDROCARBON GASES

Many claims have been made relative to the use of natural gas as hydrogenating material for oil. If gases, such as methane, ethane, and propane, are to be used directly without previous treatment for purposes of activation, extreme or hyper-pressures must be employed if justifiable yields are to be obtained, this together with high temperatures.

The presence of oxygen in such a system materially lessens the amount of pressure necessary for conversion and lowers the temperature requirements. Indications are that pressures of 4000 pounds up to 15,000 pounds together with temperatures of 950° to 1200°F. would be favorable for direct combination of heavy oil with natural gas in the presence of a suitable activating catalyst.

In order for chemical reaction to take place between two compounds, both must be in an active state for chemically active oil cannot combine with chemically inactive methane or ethane. High temperatures and pressures are required for dissociation and resynthesis of such physically mixed gas and oil systems. Reaction temperature decreases with increase of pressure. In a gaseous system the trend is towards constituents occupying a minimum volume, the other requisite being that such constituents be capable of standing the temperature imposed upon them without decomposition. The aromatics and naphthenes fulfill both requirements better than the paraffins and unsaturates as the molecular densities of both ring series is so relatively great.

It is evident upon examination that some of the so-called processes for hydrogenation of oil by the use of natural gas obtained increased yields of gasoline not from chemical conversion but from physical combination of the less volatile portions of the gas, such as butane, isopentane, etc., and from straight cracking of the oil, the natural gasoline hydrocarbons being more soluble in the higher cracked crude. It is only recently that precise methods have been available for the separation of gasoline from natural gas. The writer has investigated a number of such processes in the laboratory, and in almost every case no benefits could be attributed to other than oil cracking or physical combination. Kerosene and naphtha are better absorbents for butane, etc. than heavy residium. Methane and ethane are chemically inert in an oil cracking system at ordinarily used temperatures and pressures unless activating agents are present. The most distinct action is to act as inert gas for the production of vapor phase in accordance with the principles of partial pressure. With heavily oxygenated oils, there is evidence of hydrogenation.

There is nothing sufficiently distinctive about

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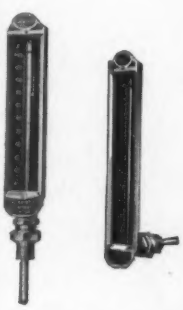

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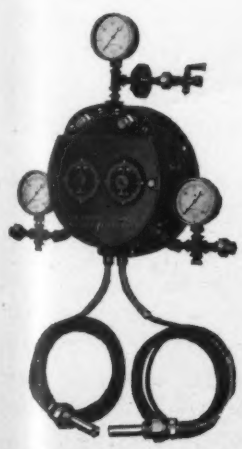

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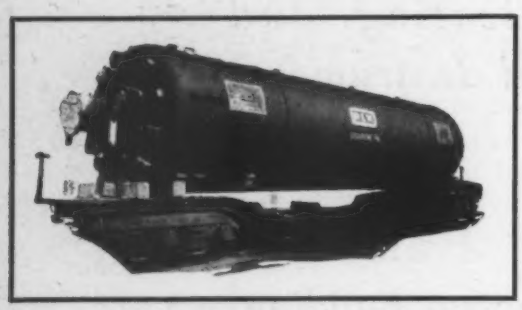

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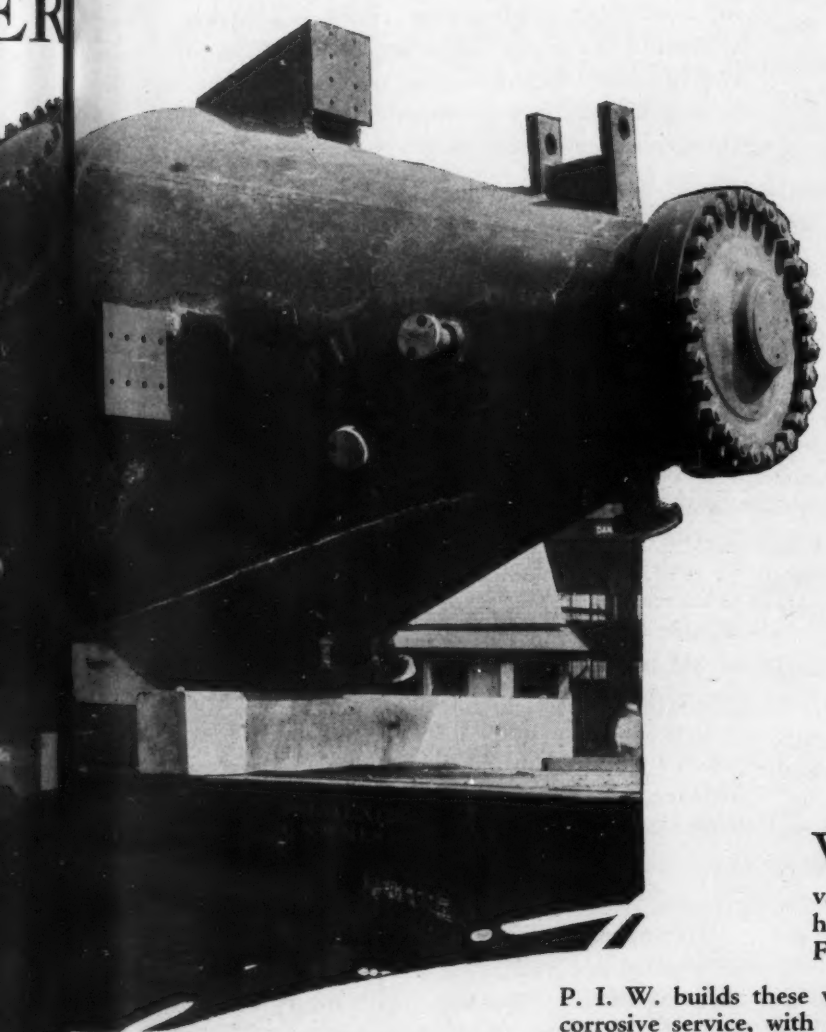

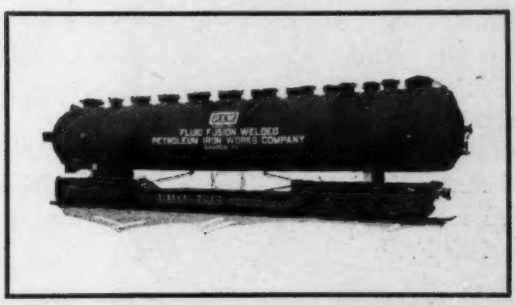

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processes for the direct conversion of natural gas with oil to warrant further discussion—at least such is the writer's conclusion. There are two directions from which to attack the problem, one depends upon the activation of the gas, the other upon the activation of the oil, both preliminary to final conversion. Of the two methods, that of preliminary gas activation is the most logical because of the few and simple compounds involved and the more specific knowledge concerning their physical and chemical natures. The two commercially attractive methods for doing this are by cracking or by oxidation.

The use of steam for heat conversion includes both cracking and oxidation as the reaction $C_nH_{2n+2} + nH_2O \rightleftarrows nCO + nH_2$ involves dissociation of both steam and hydrocarbon and subsequent oxidation of carbon. The reverse reaction is one of reduction or hydrogenation as are also reverse intermediate reactions such as the methanol ($CO + 3H_2 \rightleftarrows CH_3OH + H_2$) which takes place best at high pressure and low temperature in the presence of a catalyst, operating pressures varying from 100 to 1000 atmospheres and temperatures from 400 to 700°F.

HEAT METHOD LEAST ATTRACTIVE

Cracking natural gas by the use of heat alone is a sledge hammer method of attack, it is the least attractive commercially of proposed methods. It is not believed that straight cracking will yield much of industrial importance in the way of production of motor fuels as the tendency is too strong in the reverse direction. The cracking of methane yields a small percentage of benzene and naphthalene in addition to carbon and hydrogen, as much as one gallon of benzene per 1000 cubic feet of gas cracked has been reported. The theoretical reaction is $CH_4 \rightarrow C + 2H_2$ but there is some evidence that the reaction $6CH_4 \rightarrow 3C_2H_2 + 9H_2 \rightarrow C_6H_6 + 9H_2$ also takes place. Metal tubes are not suitable for gas cracking as the high temperatures required cause rapid deterioration both from within and without. The secret of gas cracking is in the time factor and the use of pressure. Rapid heating gives increased yields of benzene and hydrogen; rapid heating however necessitates the use of high furnace temperatures with attendant evils. It is estimated that 2100 B.t.u. will be required for the decomposition of one pound (23.1 cubic feet) of methane into carbon and hydrogen without allowance for efficiency of heat transfer or the heat required to raise the decomposition temperature. From the standpoint of thermal efficiency, the reaction $CH_4 + 2H_2O \rightleftarrows CO_2 + 4H_2$ in the presence of iron oxide would seem to have advantages, pressure lowering the reaction temperature. Both iron and carbon have the power of taking oxygen away from steam at elevated temperatures. The reactions between hydrocarbons and iron oxide and water, and water and iron oxide fall approximately within the same temperature range namely 900-1400°F. the reactions are respectively reduction and oxidation. References—A. S. Ramage, Canadian Chemical Journal, 1918 (2), 192-5; U. S. Pat. 1,224,787 and Chaudron, Compte Rendu, 1914, 159,237. Refinery and cracking still gases as well as higher hydrocarbons of natural gas should be suitable for this purpose. Producer gas could also be used.

USE OF ALUMINUM CHLORIDE

When aluminum chloride (anhydrous) is admixed with heavy oils such as fuel oil and the mixture subjected to distillation at ordinary pressures a saturated light distillate is obtained from which gasoline is fractionated. As far as the distillate is concerned, the process is one of hydrogenation, the reason lies in the fact that aluminum chloride ($AlCl_3$) forms high boiling molecular condensation complexes which cannot withstand the temperature necessary for vaporization, consequently decomposition occurs wherein nascent hydrogen and light hydrocarbons are produced — any chemical unsaturation is overcome by the activity of atomic and ionized hydrogen.

Due to the original hydrogen defficiency of the oil, a highly carbonized residium is left in the still. There are no data to the writer's knowledge available on the hydrogenation of such oils under pressure in the presence of excess hydrogen from an external source. There should be some interesting possibilities. The Friedel and Crafts reaction has great versatility and it is one of the organic chemists' favorite methods of synthesis. The gasoline produced by catalysis with aluminum chloride is somewhat similar to that produced by high pressure low-temperature cracking,—the unsaturations in each case is low as compared with ether cracked gasolines suggesting hydrogenation. Such a powerful organic catalyst should be thoroughly investigated as an aid to low pressure hydrogenation and the present low cost should offer an additional inducement. There is already a voluminous literature on the properties and action of aluminum chloride on organic material. The McAfee process of Gulf Oil Company has attracted wide attention.

PRINCIPLE OF HYDROGENATION

Hydrogenation is a chemical principle capable of widespread application. It is not one process but is the basis of many processes. The development of commercial equipment where pressures as high as 15,000 pounds per square inch and temperatures as high as 1000°F. are available, has opened up a new field for industrial research so infinite in possibilities as to stagger the imagination. It is necessary here only to mention synthetic ammonia from its elements $n_2 + 3H_2 \rightarrow 2nH_3$, methanol, directly from carbon monoxide and hydrogen, gasoline (synthol) from the same materials, oil from coal, motor fuel, lubricants and other high grade refined products by the action of hydrogen on low grade residuum and crudes, and substitute (Crisco) from the hydrogenation of cottonseed oil, etc. Therefore it need not be anticipated that hydro-

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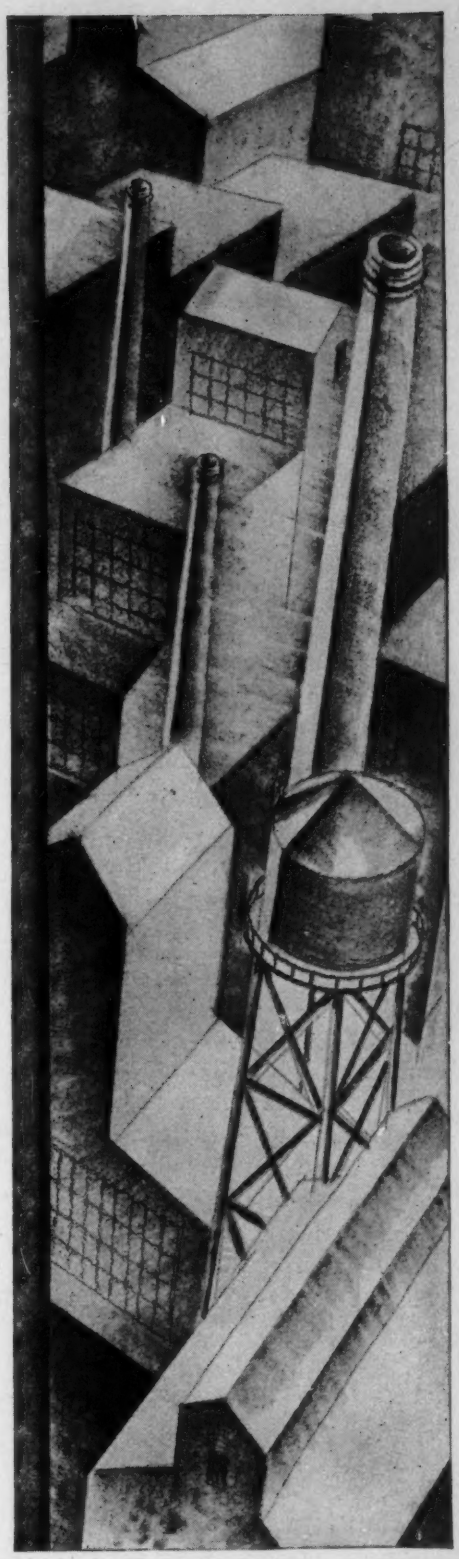
By CARL R. MILLER

No. 5 in a series of advertisements describing the position of The Mathieson Alkali Works in the chemical industry



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Great Structures Rest on Strong Foundations

genation for mineral oils will mean a cook book formula; too little as yet is known concerning the nature of oil, cracking processes as yet have not been fully exploited in spite of the fact that there are now more than 15,000 patents in the art. It is like a system of permutations and combinations of figures with a new figure thrown in. Thermo-dynamics has as yet been unable to predict what reactions will take place under heat and high pressure, mathematical formula need to be revised in order to conform to the results obtained in practice, the third law of energetics cannot be said to hold for the homogeneous high pressure gas reactions. The mechanics are those of the atomic and electromic structure of matter. There is much yet to learn.

Reactions have to be induced or energized, temperature increases to the reactivity, but does not give the necessary proximity, pressure does this as do also catalysts. There are two forces existent within molecules of matter, repellant and attractional. The repellant forces must be overcome before reaction will take place. Gases, such as hydrogen, in order to react with hydrocarbon material such as oil, must be brought into close contact, the relative distances between molecules is decreased by pressure, the attractive forces are increased by temperature. In other words, the distance is shorter between molecules, therefore less attractive force is needed to overcome the repellant forces; lower temperatures are required for the reaction to proceed.

Catalysts have the power of reducing these repellant forces, they also have the power of distortion and are capable of bringing two dissimilar molecules together by simultaneous attraction to a common point. Catalysts composed of such compounds oxygen and iron (iron-oxide) or aluminum and chlorine (aluminum chloride) have strong affinity for both carbon and hydrogen, therefore they act as positive catalysts. There are many other catalysts possible, these two are mentioned because of their ready availability. Pressure and catalysis go hand in hand, each has its uses for chemical reaction, both separately and conjunctively.

There would appear to be certain advantages to vapor phase hydrogenation from a thermodynamic standpoint as a gaseous system is in a condition of maximum energy. If high pressures are to be used in conjunction with vapor-phase, partial pressures must be lowered to insure vaporization. This may be done by the addition of excess hydrogen or of an inert atmosphere. There is an advantage gained in the quality of motor fuel from vapor phase, pressure acts favorably toward increase of yield. Where heavy oils, such as crude residuums are to be hydrogenated in the vapor phase, a preliminary hydrogenation into light oil in the liquid phase will be necessary. This is essential for two reasons, first of which is the prevention of carbon and tar formation, the second is to produce a higher partial pressure material before the final zone of heating and reaction. Less weight of hydrogen is required to produce vapor phase than any known gas, 2.016 pounds occupy 373 cubic feet at 60°F. and one atmosphere absolute, on a system gasoline-hydrogen, the equivalent weight of hydrogen on a mol pound basis would be approximately as one is to 50. The highest quality motor fuels will be produced by high pressure vapor phase treatment, the lowest temperature at which vapor phase can be induced will give the greatest yield.

CONCLUSION

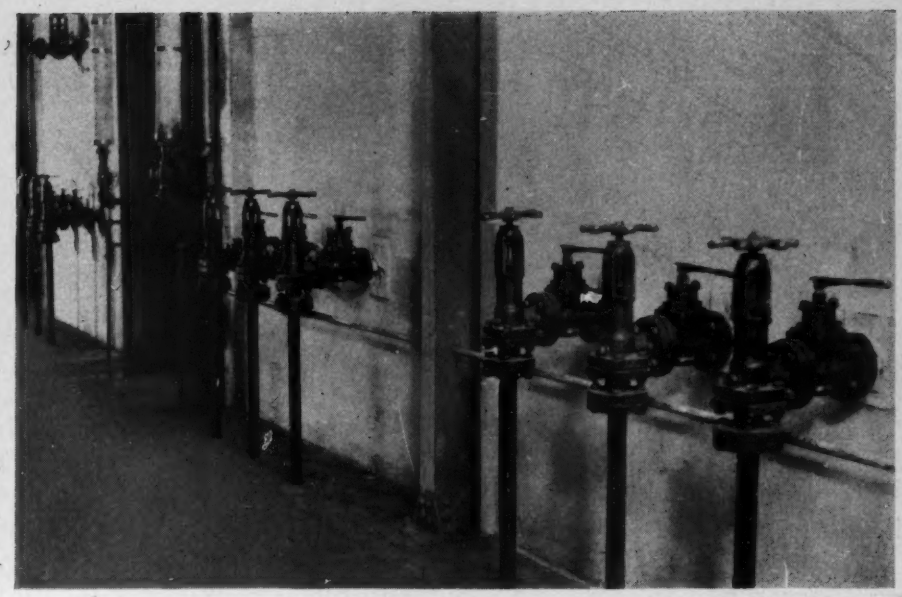
It may seem a long step from the derrick floor to the domain of quantum mechanics and theories of electrodynamics, yet it is all a part of the story of oil. Rule of thumb methods soon will no longer find a place in the refining of oils, those who look for a return of the good old days of "boiling oil" to produce all their gasoline will likely look in vain for the day of the sledge hammer methods are fast drawing to a close. The changes may not be so gradual as some are inclined to believe. For the farsighted there is a greater field for opportunity than ever for the future in the field of high pressure synthesis, hydrogenation is but one example.

Chemists Discuss Synthesis and Refining of Gasoline

(*Continued from page 95*)

Julius Hyman and C. R. Wagner of Pure Oil Company discussed "Some Factors Affecting the Catalytic Activity of Cobalt Oleate on the Autoxidation of Pentene-2." It was found that acids and bases exert considerable influence on its activity. Preliminary oxidation of the cobalt oleate produces a product which causes the disappearance of the "induction period" in the autoxidation of the olefin. An attempt was made to bring these results under a viewpoint similar to that proposed by the authors for "unpromoted" autoxidations. A series of equations was included.

C. R. Wagner, chief chemist, Pure Oil Company, was elected chairman of the Petroleum Division of the American Chemical Society for the coming year. Frank H. Hall of The Texas Company was named vice-chairman and Charles D. Lowry, Jr., research chemist for Universal Oil Products Company, was unanimously elected as secretary and treasurer. Dr. J. B. Hill, Atlantic Refining Company, who was chairman of the division before Mr. Wagner's election, was made a member of the executive committee. Dr. R. E. Wilson, Standard Oil Company (Indiana) was also named as a new member of the executive committee.



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When we say that Hovalco-Homestead Blow-Off Valves control costs we are quoting from the accumulated experiences of users.

Low first cost combined with continuous drop-tight service means lower maintenance costs and greater safety for your power plant.

For example one certified report shows that Hovalco-Homestead Valves show sufficient savings in maintenance costs alone over the valves previously used, to pay for the Homesteads every two years. An additional, and perhaps the biggest saving is the elimination of leakage.

If, after a long period of service, it is necessary to repair a Hovalco Valve, the seat and disc can be easily re-ground, reversed, or replaced. Your men can do this, and you then have a new valve at a slight cost.

Copies of certified performance records of Hovalco-Homestead Blow-Off Valves are available if you want to compare the figures with your own costs before making your decision.

Our engineers are all valve minded and will gladly suggest solutions for your valve problems in the Power Plant or in any other part of your refinery.

HOMESTEAD QUARTER-TURN VALVES

HOMESTEAD QUARTER-TURN VALVES

HOMESTEAD VALVE MFG. CO.
Box 359 Coraopolis, Pennsylvania

Tariff Encouraging Refinery Construction in Belgium

(*Continued from page* 85)

Figure 8—*Pier of plant. The refinery is located on canal leading to Ghent*

pletes this installation which is shown on photograph No. 7.

The office and laboratory building is located on a line separating the part of the plant so far described from the tank farm. The latter consists of two 55,000-barrel tanks for crude oil; three 10,000-barrel tanks for charging stock and fuel oil; three 5000-barrel tanks for finished gasoline and a small tank for benzol and casinghead gasoline. Dikes are built around the tanks in accordance with the government and insurance companies regulations.

The transport facilities of the plant are excellent. The deep water canal on which the plant is located allows two vessels up to 27 feet draft to dock alongside the plant. A small wooden pier (photograph No. 8) has been built to facilitate discharging the crude from the boats through an eight-inch pipe line to the storage tanks. Loading lines for barges are also installed on the pier. Extensive dredging had to be carried out for the above purpose.

Figure 9—*Store room and shop*

Alongside the canal is a highway leading in one direction to Ghent and the Belgian hinterland and in the other direction to Holland, the border line of which being at a distance of approximately 10 miles from the plant.

HAS RAIL FACILITIES TOO

On the other side of the plant and separated by its total width runs the railroad from Ghent to Terneuzen. A private siding has been built and runs alongside the refinery tanks where a loading rack for 10 cars has been installed. One can readily appreciate the excellent location which gives shipping facilities by water, rail and truck with a minimum handling.

Auxiliary buildings and equipment not mentioned before are as follows:

(a) Electric substation which transforms the high tension electric current furnished by the power company down to 500 and 110 volts respectively; (b) sewer oil separator built for the purpose of not letting any oily substance go into the canal not only to avoid pollution but also to save any product that can be utilized; (c) a brick building housing a store room, a small mechanical and blacksmith shop and a men's wash room (photograph No. 9); (d) a garage to accommodate six cars with provision for future development; (e) a water pump house containing a motor driven centrifugal pump and a spare steam pump, supplying the plant with water from the canal for cooling purposes; (f) a concrete fence, eight feet high, built of hollow cubes runs around the plant.

Making out the plant layout, the company's and the Graver Corporation engineers have taken every precaution in order to enable a very substantial enlargement of the plant capacity.

Space has been put aside for the installation of a second cracking unit as well as of a pipe still. Other equipment already is adequate to handle the double of the plant's actual capacity.

At the present time arrangements have been made to treat approximately 1200 barrels of fresh charging stock per day and produce and distribute about 600 barrels of gasoline.

Two grades of gasoline will be made viz: a premium product with not over 400°F. end point and an ordinary commercial degree of gasoline. No definite arrangements have been made so far for handling the residue from the pressure still, but it is contemplated to transform same into a heavy distillate (Diesel oil) and a solid residue.

A Paying Investment in any Refinery

Where high temperatures prevail—where severe slag action, clinker adhesion or spalling influences tend to make difficult the selection of refractories—in the settings of boiler and stills of all types—wherever brick meets heat — there, Harbison-Walker refractories will quickly demonstrate their ability to meet the needs of the oil refining industry.

Harbison-Walker first quality fireclay brick for high heat duty service and Harbison-Walker high-alumina brick to meet extreme operating conditions will prove a paying investment. By bonding the brick with Thermolith or Firebond the investment will be doubly secured.

Correspondence or a personal interview will quickly bring full information regarding the type of refractory best suited to your particular needs.

HARBISON-WALKER REFRACTORIES COMPANY

World's Largest Producer of Refractories

PITTSBURGH, PENNSYLVANIA OFFICES IN PRINCIPAL CITIES

European Refining—Today and Tomorrow

(*Continued from page 72*)

about 50 barrels capacity daily, has been in operation for some time.

RUMANIA

Rumania has a total of 70 refineries of which only 33 may be said to be of significance. Table A gives a detailed statistical report on the activities of these 33 refineries for the year 1929.

The growing demand for oil products of a superior quality has brought about radical improvements in the fractionation practice and numerous practical methods applied in wine rectification are applied by the principal refiners in their plants. The adoption of improved distillation processes and augmentation of the yields from crude oil have been the principal accomplishments.

During pre-war periods the local refiners employed as much as 12 per cent fuel from the crude oil treated. With the introduction of radiant heat economisers, the improvement of the preheaters and the giving of special attention to the water feeding of the stills, the figure of fuel consumption has been reduced to five per cent in recent years. The adoption of distillation stills on which the dephlegmators are directly mounted has resulted in a fuel economy alone of nearly 20 per cent in certain refineries.

Three local refineries have established pipe still distillation plants, Steaua Ramona at Moinesti, Romano-Africana and Unirea at Ploesti. Two such plants are operated on the German "Borrman" process and one on an American process. These plants have resulted in reducing the fuel consumption in the respective refineries to three per cent and the refining loss to one per cent.

Notwithstanding the above mentioned development there is a great field in the local industry for the introduction of improved processes and plants for the augmentation of the yields.

The percentage of gasoline obtained from the total amount of crude oil produced was the same in 1928 as in 1913, namely 23.6 per cent. The percentage of kerosene declined from 21.3 per cent in 1913 to 16.8 per cent for 1928. The product of lowest value, fuel oil made up of 50.7 per cent of the crude oil treated in 1913 and 48.4 per cent on 1928.

The large quantities of fuel oil resulting from the first distillation of the crude, the limited demand and consequent depreciation in price for this period, have given rise to introduction of cracking processes by the Rumanian Oil Industry.

Romano-Americana, local subsidiary of Standard Oil Company of New Jersey, has an American cracking plant in operation, and three companies, i.e., Astra-Romana (Royal Dutch) Steaua Romana, and Colombia are likewise using American cracking processes.

There are at present 12 cracking units in Rumania having a treating capacity of approximately 20,000 barrels of fuel oil per day "on stream."

From Rumanian cracked fuel oil some 36 per cent of medium gasoline with a specific gravity of 0.740 is obtained when the residue is coke and as much as 30 per cent gasoline if, instead of coke, liquid residues are the end products.

RUMANIAN REFINERIES, 1929

Name of Refinery—Location	Annual Refining Capacity In Barrels			
	Distillation	Treating	Re-running	Lub. Oils
Steaua Romana—Campina	7,250,000	1,740,000	1,305,000	542,400
Steaua Romana—Moinesti	435,000	261,000	.....	.....
Steaua Romana—Arbanasi	130,000	.....	.....	.....
Astra Romana—Ploesti	5,800,000	725,000	870,000	610,200
Orion—Ploesti	3,625,000	652,000	652,500	203,400
Speranti—Ploesti	1,435,500	565,500	362,500	.....
Vega—Ploesti	4,350,000	1,131,000	1,218,000	325,440
Aurora—Baicoi	2,610,000	652,500	1,044,000	.....
Fratia—Ploesti	507,500	126,875	203,000	.....
Orsova—Orsova	348,000	87,000	139,200	122,040
Tileagd—Tileagd	348,000	87,000	139,200	122,040
Romano-Amer.—Teleajen	3,770,000	1,450,000	1,087,500	440,700
Standard—Ploesti	3,045,000	761,250	696,000	183,060
Satun—Buzan	783,000	522,000	232,000	16,950
Baneasa—Buciresti	217,500	130,500	58,000	162,720
Columbia—Cernavodo	1,323,125	264,625	264,625	.....
Columbia—Ploesti	1,305,000	507,500	362,500	.....
Redeventa—Ploesti	1,595,000	870,000	398,750	.....
Corneta—Ploesti	884,500	253,750	152,250	.....
Petrol-Latina—Plopeni	522,000	203,000	36,250	.....
Dacia—Ploesti	507,500	253,750	130,500	.....
Lumina—Ploesti	507,500	181,250	130,500	.....
Camen-Petrol—Targoviste	435,000	217,500	108,750	.....
Photogen—Brasov	377,000	188,500	130,500	40,680
Xenia—Ploesti	253,286	.....	26,158	.....
Susanne—Targoviste	53,230	6,888	6,090	.....
Norris—Ploesti	264,625	156,600	130,500	.....
Industria Petrol—Dej	261,000	152,250	79,750	67,800
Intrep. Pet.—Dej Grigorescu—Targoviste	261,000	156,600	145,000	.....
Pallas—Calati	253,750	101,500	101,500	.....
Moldonaphtha—Mornesti	156,600	65,250	31,175	.....
Venus—R. Sarat	108,750	54,375	32,625	.....
Petrolut Buzan—Buzan	108,750	38,062	15,225	.....
Others—Buzan	51,721	14,754	.....	14
Total	43,884,337	12,578,279	10,289,548	2,837,444

CRUDE OIL HANDLED 1929 BY 10 LARGEST REFINERS (RUMANIA)
(In Barrels 42 Gallons)

Steaua Romana	6,075,776
Astra Romana	5,182,409
Vega	4,021,437
Phoenix Oil Group	3,349,420
Romano Americana	3,747,293
Creditul Minier	2,494,711
Standard	2,176,254
Colombia	1,357,091
Redeventza	1,083,331
Petrolul Bucresti	582,240

STA-VOL-ENE

STABILITY ◇ VOLATILITY ◇ ENERGY

A PRODUCT OF NATURAL GASOLENE

TRADE MARK REG.

IS AVAILABLE FOR EXPORT AND COASTWISE SHIPMENT

IN ANY QUANTITY "FROM A CAR TO A CARGO"

with Extremely Low Shipping and Handling Losses!

Foreign and Seaboard Refiners and Marketers are finding STA-VOL-ENE to be the ideal natural gasoline product to blend with heavy gasolines and benzines. STA-VOL-ENE has extraordinary Stability, Volatility and high anti-knock value. These qualities enable blenders to increase profits because with the use of STA-VOL-ENE it is possible to make quality products from low grades of gasoline. STA-VOL-ENE permits refiners to cut much deeper into crude thereby increasing yields of motor fuel per barrel of crude.

STA-VOL-ENE increases volatility and anti-knock value for refiners and blenders without any sacrifice in Stability, and is guaranteed to cause no vapor lock trouble.

STA-VOL-ENE is high gravity and its volatility is produced by our scientific process which eliminates all gaseous fractions, consequently STA-VOL-ENE can be shipped and handled with losses no greater than ordinary gasoline.

Export orders will receive prompt attention, and will be shipped either C. I. F. or F. O. B. our Good Hope, Louisiana, processing plant (New Orleans Port). Write or wire for complete information. Cable address, "STAVOLENE," Tulsa, Oklahoma, U. S. A.

HANLON-BUCHANAN, INC.

GENERAL OFFICES – TULSA, OKLAHOMA

GERMAN PETROLEUM

Refineries (Official Name)	Location	Owner Concern	Capital Foundation (Marks)	Factors Controlling Owner Concern
1. Deutsche Petroleum A. G. Erdoelwerke, Wilhelmsburg-Harburg, Reiherstiegdeich 252.	Wilhelmsburg a/d Elbe bei Hamburg	Deutsche Petroleum A.G. Berlin-Schoeneberg	35,000,000	a) Deag, Berlin b) Rutgers Werke A.G., Berlin c) Depag, Berlin
2. Deutsche Petroleum A. G. Erdoelraffinerie, Hannover-Iinden, Schlorumpfsweg 1.	Hannover-Linden	Deutsche Petroleum A.G. Berlin-Schoeneberg	35,000,000	a) Deag, Berl'n b) Rutgers Werke A.G. Berlin c) Depag, Berlin
3. Deutsche Petroleum A. G. Mineraloel-Raffinerie, Rheinau.	Mannheim-Rheinau	Deutsche Petroleum A.G. Berlin-Schoeneberg.	35,000,000	
4. Deutsche Petroleum A. G. Danubia A. G. fuer Mineraloel industrie, Regensburg, Straubingerstrasse 26.	Regensburg	Deutsche Petroleum A.G. Berlin-Schoeneberg.		
5. Deutsche Gasoline A. G. Fabrikbetrieb Emmerich, Emmerich (Rhein) Reeserstrasse 3.	Emmerich (Rhein)	Deutsche Gasolin A.G. Berlin-Schoeneberg	11,000,000	German Dye Trust 52% Royal Dutch Shell 24% Standard Oil N. J. 24%
6. Deutsche Gasolin A. G. Erdoelwerke, Dollbergen.	Dollbergen	Berlin-Schoeneberg Badenschestrasse 2.	11,000,000	German Dye Trust 52% Royal Dutch Shell 24% Standard Oil N. J. 24%
7. Berlinr-Benzin Werke m.b.H., Berlin-Lichtenberg, Rittergutstrasse 102/103.	Berlin Lichtenberg	Deutsche Petroleum A.G.	35,000,000	See above
8. Raffinerie Monheim. 9. Raffinerie Reisholz (Duesseldorf). 10. Raffinerie Hamburg-Grasbrook. 11. Raffinerie Freithal b. Dresden. 12. Raffinerie Wilhelmsburg. 13. Raffinerie Regensburg. 14. Raffinerie Harburg a.d. Elbe.		Rhenania-Ossag Mineraloelwerke A.G. Duesseldorf Rhenaniahaus Gartenstrasse 2	100,000,000	Royal Dutch Shell
15. Mineraloraffinerie, Dr. W. H. Depenau u. Co., G.m.b.H.	Salzbergen b/ Osnabrueck	Norddeutsche Mineraloel A.G., Hannover Augerstrasse 12	2,200,000	
16. Mineraloelraffinerie.		Norddeutsche Mineraloel A.G., Hannover	2,200,000	
17. Zeller & Gmelin Mineraloelraffinerie, Eislingen a. Fils (Wurtemberg).	Eislingen	Zeller & Gmelin		
18. Mineraloelraffinerie vorm. Aug. Korff, Bremen.	Bremen	Deutsch-Amerikanische Petroleum Ges. Hamburg, Neuer Jungfernstag 21	40,000,000	
19. Deutsche Vacuum Oil A. G. Hamburg, Spitalerstrasse 12.	Oslebshausen b/ Bremen	Deutsche Vacuum Oel A.G., Hamburg.	20,000,000	
20. Deutsche Vacuum Oil A. G. Hamburg, Spitalerstrasse 12.	Wedel in Holstein	Deutsche Vacuum Oel A.G., Hamburg	20,000,000	
21. Mineraloelwerke Albrecht & Co. K.G., Hamburg 1, Glockengiesserwall 2/4.	Hamburg	Albrecht Family		Agreement with Sun Oil Co.
22. Oelwerke Julius Schindler G.m.b.H., Hamburg 36, Hohe Bleichen 28.	Hamburg	Oelwarke Julius Schindler	2,400,000	Pure Oil Co Chicago, Julius Schindler
23. Ernst Schliemann's Oelwerke G.m.b.H., Hamburg 8, Catharinenstrasse 38/39.	Wilhelmsburg b/ Hamburg	Ernst Schliemann's Oelwerke		
24. Ebano Asphaltwerke, Harburg-Wilhelmsburg.	Hamburg	Ebano-Asphaltwerke	5,000,000	Pan American Petroleum & Transport Co. Mexican Petroleum Corp., Los Angeles
25. Mineraloel und Asphaltwerke Raffinerie, Ostermoor.	Berlin	Mineraloel-u. Asphaltwerke, Berlin	2,000,000	Dr. Louis Grotginger, Berlin Friedrich Minoux, Berlin
26. Mineraloel und Asphaltwerke Raffinerie, Fabrik Offenbach.	Berlin	Mineraloel-u. Asphaltwerke, Berlin	2,000,000	Dr. Louis Grotginger, Berlin Friedrich Minoux, Berlin
27. Mineraloelwerke Lichtenberg, Berlin-Lichtenberg, Herbergstrasse 35.	Berlin W. 35. Schoeneberger Ufer 30.	Mineraloelwerk Lichtenberg G.m.b.H. Kom. Ges.	1,245,000	Shareholders: Sigberg Seelig, Berlin Theo. Seifen, Duesseldorf Max Riesebrodt, Berlin

REFINERIES

Foreign Holders if any a) Amount Invested b) By Whom	Refinery Output By Product	Refinery Capacity By Product (Metric tons)	Refinery Equipment
	Gasoline, kerosene, gas oil, lubricants and asphalt.	60,000 total	One of the largest and best equipped German refineries.
	Closed down at present.	15,000 total	Distillation and refining of crude oil and oil products.
	Closed down at present.	6,000 total	
	Closed down at present.	20,000 total	High vacuum distillation plant, refinery plant, tank storage generator plant. Tank storage has 9,000-ton capacity.
Royal Dutch and Standard Oil	Gasoline, kerosene, gas oil, lubricants and asphalt.		Distillation and refining plant.
	Gasoline, kerosene, gas oil, lubricants and asphalt.	15-20,000	Distillation and refining plant.
	Gasoline for industrial use.	6,000	Gasoline, re-distilling plant.
Royal Dutch Shell 60% Dutch Bataafsche Petroleum Co., 40% British German capital participates in Royal Dutch.	8. Refines and blends lubricants. 9. Gasoline for industrial use. 10. Refines and blends lubricants. 11. Refines and blends lubricants. 12. Gasoline for industrial use. 13. Gasoline for industrial use. 14. Asphalt.		8. Distillation and refinery of oil products for lubricant oils. 9. Gasoline re-distilling plant. 10. Lubricants refinery. 11. Lubricants refinery. 12. Gasoline refinery, re-distilling plant. 13. Gasoline refinery, re-distilling plant. 14. Asphalt refinery.
	Gasoline, kerosene, gas oil, turbine and cylinder oils.	10,000	Distillation and refining of crude oil and oil products.
	Gasoline, kerosene, gas oil, turbine and cylinder oils.		Distillation and refining of crude oil and oil products.
	Refines and blends lubricants and gasoline for industrial use.		Lubricants refinery, gasoline re-distilling plant.
Standard Oil	Refines and blends lubricants.		"Reservoirs 51,800 sq. meters in extent." Lubricants Refinery.
	Transformer oil, turbine oil, greases, refines and blends lubricants only.	100,000	High vacuum distillation plant, refinery plant.
	Transformer oil, turbine oil, greases, refines and blends lubricants only.		High vacuum distillation plant, refinery plant.
Sun Oil Co. 50%	Transformer oil, turbine oil, refines and blends lubricants.		Lubricating oil refinery.
Pure Oil Co. 50%, Chicago		30-35,000	160 tank cars, 10,000 iron barrels, tank steamers, tanks of about 35,000-ton capacity, etc.
	Refines and blends lubricants only.		Lubricating oil refinery.
Mexican Petroleum Corp., Los Angeles, 100%	Asphalt, gas oil.	250,000 tons, can be enlarged to 400,000 tons	Pipe-still distillation plant.
50% 50%	Asphalt, gas oil and lubricants.	About 40,000 tons	Distillation plant. Tank plant of about 80,000 tons capacity rented from State.
	Asphalt.		Asphalt distillation plant.
	Gasoline, kerosene, gas oil, asphalt and lubricants.	40-50,000 tons	Distillation and refinery plant. System Borrmann.

SPAIN

On January 1, 1928, the Spanish government took over the control and operation of the oil business in Spain as a nationalized industry.

Spain's first complete refinery to be built by an American firm for Componia Espanola de Petroleos, at Santa Cruz de Tenerife, Canary Islands, will have a daily capacity of 5,000 barrels throughput. The construction cost is set at approximately $1,250,000 in the contract signed in February, 1930, and the plant is to be completed by the end of the year. The crude oil will come from Venezuela and the products sold chiefly to the Spanish Petroleum Monopoly, which according to reports, has agreed to purchase a minimum of 1,260,000 barrels of products annually for a three-year period.

A second and larger plant is being planned for Barcelona. Tenders have been solocited for a plant capable of refining 4,900 barrels a day throughput and susceptible to enlargement to a capacity of 10,500 barrels a day. It is to be located in the free zone of the port of Barcelona.

ITALY

Italy is a large importer of refined oils, has practically no production but is gradually increasing its domestic refining industry.

The largest and most important refinery is located at Fiume and is owned by Raffineria Olii Minerali Societa Anonima in which a controlling interest is held by the Italian government. It uses Russian crude oil and has a capacity of 350,000 barrels annually. It also has one unit (four stills) of the Holmes-Manley cracking process with an output of approximately 212,500 barrels of gasoline annually. In 1929 the yields for the entire plant were gasoline 40 per cent, fuel oil 15 per cent, cycle gas oil 43 per cent, coke and gas two per cent.

At Trieste there is another refinery, of the same capacity of the above, owned by Raffineria Triestina, S. A., whose output is mostly lubricating products. It is now being run at approximately half capacity.

At Spezia the Dutch Shell interests control a refinery with an annual gasoline output of 240,000 barrels. This plant has two Dubbs cracking units and operates on Rumanian residual fuel oil.

Two additional refineries are under construction, one in Venice with an annual crude capacity of 210,000 barrels and the second in Naples with an annual output capacity of 245,000 barrels.

BELGIUM

A new refinery, and the only one of importance in Belgium, owned by Raffineries Nationales de Petrole and located on a 30-acre tract at Selzaete near Ghent on the Fernangen Canal, started operations in July of this year. It is using the Jenkins cracking process and has a reported output of 600 barrels of gasoline a day. The output of other products is not known. Its crude oil comes from the Mexican properties of the Anglo-Belgian Petroleum Company, Ltd., of London.

CZECHOSLOVAKIA

In Czechoslovakia a total of 11 refineries have a total annual crude oil capacity of 2,499,875 barrels but six plants account for 84 per cent of the total capacity. Of the remaining plants two handle no crude but semi-refined products, largely lubricating oils. No refinery uses any cracking process and no natural gas or natural gasoline plants are found.

From these figures it is seen that Czechoslovakia has no refining industry of importance.

FRANCE

At present France has two completed and operating refineries, two under construction and one small oil shale plant. Those in operation are the Pechelbroun refinery of Societe Anonyme Pechelbroun located at Merkwiller-Pechelbroun, Bas-Rhin, with an annual capacity of 630,000 barrels throughput and the Courchelettes refinery with an annual capacity of 110,000 barrels. This latter is a subsidiary of the Anglo-Persian interests.

The two refineries under construction are the plant at Etang de Bene near Marseilles belonging to Produite Chimiques et Raffineries de Berre, 76 Rue Prony, Paris, and the refinery at La Petite Couronne near Rouen owned by Royal Dutch interests. The plant at Etang de Bene is rapidly nearing completion and will have an annual capacity of about 406,000 barrels. The refinery at La Petite Couronne is almost completed and is said to have an annual capacity of 2,800,000 barrels.

Some early reports show a total of 13 refineries in France but practically all of these are obsolete and inactive so the above represents the actual picture today.

The French Government as a participant in the Turkish Petroleum Company in Iraq has discussed the idea of government financial interest in a large scale refining operation to handle its share of the Iraq crude oil, but pending commercial production in this area which will be several years in the future, other laws to permit the co-operative refining of present commercial interests in France and several other proposals have been made. The situation is far from settled and no indication of probable trends can be made at this time.

POLAND

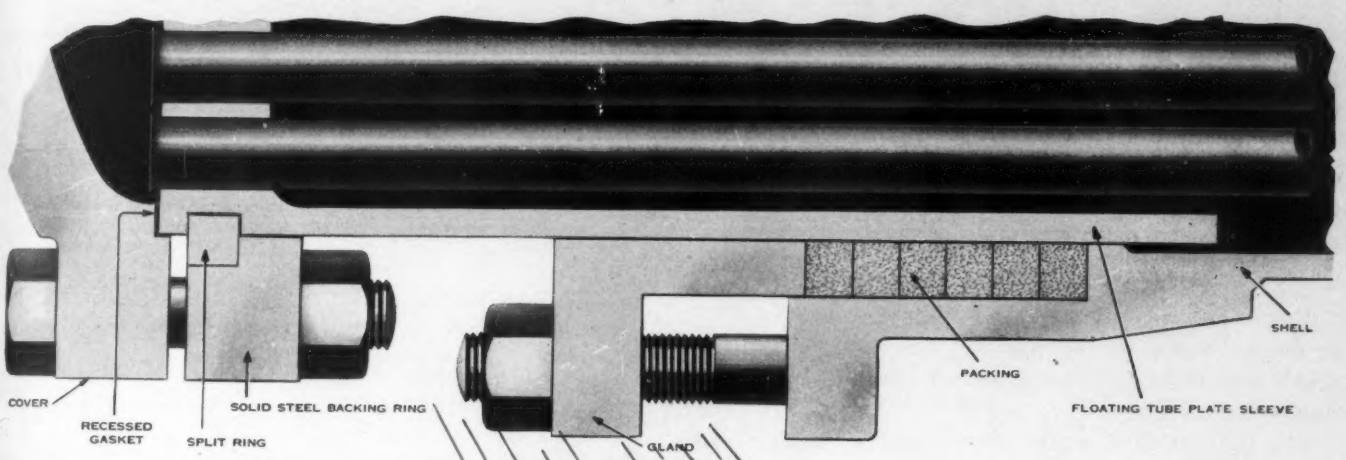
While there is a total of 49 refineries in Poland only 12 have a daily capacity of 1000 barrels or more and 26 are rated at a capacity of slightly over 100 barrels a day. These 26 were almost entirely shut down in 1929.

In common with the oil industry in other countries, the Polish refining industry has been depressed for some time, equipment is not being added to or improved and the outlook is not promising.

GERMANY

In 1928 30 German refineries are reported to have treated a total of 638,000 metric tons (approximately 4,000,000 barrels) of crude and semi-finished products.

4 **NO INTERNAL JOINTS WITH GASKETS. The outside packed joint is accessible and may be adjusted without disturbing operation. There can be no unseen gasket leaks.**



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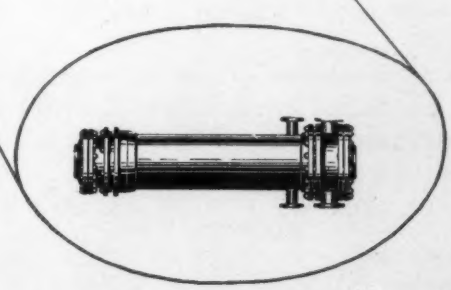

83

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Russian Refinery Industry, Calendar Year, 1929

	No. of Operating Plants	Crude Rec'd for Refining (Barrels)	Total Refined Products *1 *2	Gasoline Prod. (Barrels)	Kerosene Prod. (Barrels)	Lubricating Oil Prod. (Barrels)	Gas Oil Prod. (Barrels)	Fuel Oil Prod. (Barrels)	Vaseline and Transformer Oil Production (Metric Tons)	Asphalt (Metric Tons)
I. Transcaucasian Soviet Federated Socialist Republics	22	63,620,594	7,218,436	3,090,481	13,147,410	2,316,195	5,282,263	19,779,480	5,544	473,953
1. Azneft: Baku Refinery	21	61,390,615	6,892,108	3,090,481	12,857,203	2,316,195	4,756,957	18,578,203	5,544	473,953
2. Azneft: Batum Refinery	1	2,229,979	326,328	.....	290,207	.....	525,306	1,201,277	....	.....
II. Russian Soviet Federated Socialist Republic	14	41,068,895	4,904,504	6,522,101	6,132,165	366,772	1,373,875	16,120,069	15,006	15,562
1. Azneft: Leningrad Refinery	1	119,963	15,289	.....	.....	27,727	12,260	36,417	755	953
2. Grozneft: Grozny Refinery	9	33,951,492	4,086,795	5,451,968	5,003,873	103,040	1,115,427	14,069,829	....	10,243
3. Grozneft: Krasnoder Refinery	1	1,269,632	160,479	35,386	223,696	588	27,905	479,713	....	.....
4. Grozneft: Tuapse Refinery	1	2,497,900	348,342	1,032,750	589,093	.....	18,255	901,051	....	.....
5. Embaneft: Konstanlenovsky Refinery	1	2,001,432	200,150	.....	223,929	141,456	163,814	373,406	9,261	1,575
6. Embaneft: Varinsky Refinery	1	1,228,476	95,449	1,997	91,574	93,961	36,214	259,653	5,050	2,791
III. Uzbec Soviet Socialist Republic Uzbecneft Refineries	2	127,912	18,885	12,385	28,846	.....	.....	77,815	3	6
Total for U. S. S. R.		104,817,401	12,141,825	9,624,967	19,308,421	2,682,967	6,656,138	35,977,364	20,553	489,521

*1—Total refined products includes other products not listed in above table.
*2—Metric tons.

In 1929 27 refineries as listed in the following table were reported.

German refining and technical interest has centered on hydrogenation for the past several years and in general most German plants are important from a technical rather than a quantitative point of view.

RUSSIA

Russia has a total of 38 oil refineries which in 1929 received 104,817,401 barrels of crude oil for refining and converted this amount into 76,500,000 barrels of finished products.

The oil industry in all its branches is 100 per cent government owned and controlled in Russia so that total figures for the entire country reflect the condition of the industry.

Gasoline yields are still exceedingly low in spite of the large sums spent for new and improved refining equipment. There is no immediate prospect of any marked improvement in the Russian refining industry due to lack of the necessary capital and credits.

The industry is divided into three major divisions as are indicated in the following table of Russian refining statistics for 1929, the latest period for which figures are available.

Bibliography of Foreign, Refining and Technical Articles Appearing in Refiner and Natural Gasoline Manufacturer

January, 1930, page 135—American Designed Refinery Operating in Germany.

January, 1930, page 108—Refining in Mexico, by George Blardone.

February, 1930, page 128—Peruvian Pioneered American Refining, by Roy E. Leigh.

February, 1930, page 140—Cracking Efficiency with Low Capacity in Belgium.

February, 1930, page 154—Cooperate Refinery in France.

February, 1930, page 156—Bids Wanted for Building Spanish Refinery.

March, 1930, page 144—New Refinery for France.

April, 1930, pages 155-160—Five Foreign Refineries Reported—Plant Activities Department.

June, 1930, page 67—French Refiners Plan Construction Program, by Roy E. Leigh.

June, 1930, page 164—Four Foreign Refineries Announced.

July, 1930, page 164—Gyro Units in England Completed. Royal Dutch Gets Hydrogenation.

August, 1930, page 142—Refinery Capacity Expansion, includes four new refineries.

August, 1930, page 89—Practical Results with the Edeleanu Process, Dr. J. Rosenburg.

February, 1929, page 83—Trinidad Would Encourage Location of Refineries There, by Roy E. Leigh.

May, 1929, page 74—Shell Company's Refinery at Curacao, by Roy E. Leigh.

June, 1929, page 69—Rumanian Refineries, by H. E. Cassidy.

October, 1929, page 67—Refining Industry Has Fertile Field in South America, by Roy E. Leigh.

October, 1929, page 66—South American Natural Gasoline Industry.

November, 1929, page 56—The Carburol Cracking Process, by Dr. Karl Bender.

December, 1929, page 85—Application of the Pipe Still for Processing Russian Crudes, by E. Geppelt Jr.

January, 1929, page 75—Economically Constructed Plant in Trinidad, by Roy E. Leigh.

July, 1928, page 71—Recovery of Natural Gasoline from Field and Refinery Gases—European Practices, by Ion Edeleanu.

July, 1928, page 88—Zuderhoudt Process of Low Temperature Carbonization.

August, 1928, page 66—Cracked Gasoline by the Blumner Process.

May, 1927, page 57—Catalytic Oil Cracking Process.

Polish Refining Industry Advances

(*Continued from page 96*)

insofar as production of petroleum products is concerned is indicated by the following tabular data taken from the Trade Information Bulletin 623 previously mentioned:

OUTPUT OF POLISH REFINERIES
(In Metric Tons)

Product—	1927	1928
Gasoline	90,283	96,749
Kerosene	203,506	216,712
Fuel Oils	115,568	126,491
Lubricating Oils	94,029	107,920
Paraffin	37,433	40,249
Greases and miscellaneous	77,475	75,862
Total—tons	618,294	663,983

The accompanying list of refineries in Poland indicates something of the different nationalities interested in exploitation of the petroleum resources of this country and includes American, English, French, Austrian, Belgian and Swiss interests. Location of refinery and name of company is given, and under the heading, "Source of Crude Oil" the table shows whether oil is secured from the operating firm's own wells, or through royalties paid by other producers or by outright purchase.

TYPE OF CRUDE OIL

Practically all of the crude oil processed in Poland comes from the oil fields of Galicia, the principle center of which is Boryslaw. Roy E. Leigh, associate editor of The Oil Weekly, now engaged in a world-wide survey of the petroleum industry for the Gulf

OIL REFINERIES IN POLAND

Prepared by GILBERT REDFERN, *Assistant Trade Commissioner,*
Warsaw, Poland, 1930.

Location	Company	Nationality	Equipment	Source of Crude Oil	Annual Capacity (Metric Tons)	Crude Oil Run to Stills in Year 1929 (Metric Tons)
Drohobycz	"Polmin" Panstowa Fabryka Oleiow Mineralnych	Polish (Government)	Renewed in 1919-1923	Royality	300,000	102,055
Limanowa	Towarzystwo Naftowe "Limanowa" Spolka z ogr. odp.	French	Old	Own	120,000*	57,640
Czechowice	Vacuum Oil Company, Spolka Akcyjna	American	Renewing	Purchase	100,000*	37,134
Drohobycz	Galicyjskie Towarzystwo Naftowe "Galicja," Spolka Akcyjna	French-Austrian	Old	Own	100,000*	60,336
Trze bin i a	Polskie Zwiazkowe Rafinerje Olejow Skalnych, Spolka Akcyjna	French	Old	Own	80,000*	66,103
Glinik Marjampolski	Galicyjskie Karpackie Naftowe Towarzystwo Akcyjne, (formerly Bergheim & McGarvey)	French	Old	Own	70,000*	54,739
Dziedzice	Galicyjskie Karpackie Naftowe Towarzystwo Akcyjne, (formerly Bergheim & McGarvey)	French	Old	Own	60,000	Shut Down
Nieglowice, near Jaslo	"Jaslo", Zaklady Przemyslowo Naftowe Gartenberg & Schrier, Spolka Akcyjna	Polish	Old	Purchase	70,000	31,377
Libusza, near Corlice	Standard Nobel w Polsce, Spolka Akcyjna	American	Constructed 1920-1923	Own	60,000	34,403
Jedlicze	Galicyjskie Karpackie Naftowe Towarzystwo Akcyjne, (formerly Bergheim & McGarvey)	French	Constructed 1920-1923	Own	60,000	46,876
Ustrzyki Dolne	Spolka Akcyjna "Fanto", (Malapolska Group)	French	Renewed 1920-1921	Own	50,000*	1,902
Drohobycz	Polskie Zwiazkowe Refinerje Olejow Skalnych,	French	Renewed 1920-1921	Own	40,000*	36,797
Drohobycz	Spolka Akcyjna "Nafta," (Malapolska Group)	French	Renewed 1921-1923	Own	60,000	42,018
Krosno	Fabryka Nafty "Walerjan Stawiarski i Ska.", Spolka Z Ogr. Odp.	Polish-Belgian	Old	Own	30,000	2,997
Zniessienie, near Lwow	Spolka Skcyjna dla Przemyslu Naftowego i Gazow Ziemnych	Polish	Renewed 1920-1924	Own	18,000	18,552
Mykietynce, near Stanislawow	Pierwaza Stanislawowska Fabryka Nafty Oleju Maszynowego i Benzyny Eisiga Chain Griffia	Polish	Old	Own & Purchase	10,000	4,478
Ligto Pszczunska	"Naftamin," Spolka Akcyjna dla Przemyslu Naftowego	Swiss-Polish	Renewed 1926	Purchase	14,000	5,444
Stanislawow	Rafinerja Nafty i Fabryka Olejow Maszynowych, Bcia Haber, Spolka z ogr., odp.	French-Polish	Old	Own	12,000	8,744
Stryj	Rafinerja Nafty i Fabryka Olejow Maszynowych E.H.Reich i Ska., Spolka z o. o.	French-Polish	Old	Purchase	12,000	Shut Down
Skawina	Rafinerja Skawinska Zaklady dla Przemy-Oleju Skalnego, Griffel i Ska.,	Polish	New Constructed in 1924	Own & Purchase	14,000	10,497
Grabowiez, near Stryj	"Eka," Rafinerja Olejow Mineralnych, Spolka z ogr. odp.	Polish-Austrian	Old	Own	10,000	6,056
Stroze	Spolka Akcyjna "Kaukaz,"	Polish	Old	Own	6,000	Shut Down
Raniowice, near Drohobycz	Polski Przemysl Naftowy, Spolka Akcyjna	Polish-English	Old	Own	6,000	Shut Down
Targowiska, near Iwonicz	Rafinerja Nafty "Iwonicz," Spolka z o. o.	Polish	Old	Purchase	6,000	729
Derezyce, near Drhobycz	Dr. Bacher i Spolka, Rafinerja Olejow Mineralnych	Polish	Old	Purchase	6,000	Shut Down
Drohobycz	Krajowa Rafinerja Nafty i Fabryka Wytworow Chemicznych "Frymeta," Spoka z ogr. odp.	Polish	Old	Purchase	6,000	Shut Down
Derezyce, near Drohobycz	Derezycka Rafinerja Olejow Mineralnych Fabryka Produktow Chemicznych Spoka z ogr. odp.	Polish-French	Old	Purchase	12,000	4,772
Kolomyja	"Polska Nafta," Spolka Akcyjna	Polish	Old	Own	6,000	Shut Down
Gleboka, near Sambor	Rafinerja Nafty "Gleboka," Spolka z o. o.	Belgian	Old	Purchase	6,000	Shut Down
Lisko, near Sanck	Malopolski Przemysl Olejow Mineralnych Spolka z ogr. odp.	Polish	Old	Purchase	6,000	972
Hrubicze, near Drohobycz	"Gazolina," Spolka Akcyjna	Polish	Old	Own	6,000	153
Bolzka, near Bolechow	"Bolechow" Zwiazkowa Rafinerja Nafty i Zaklady Przemyslowe, Spolka z ogr. odp.	Polish	Old	Own	6,000	922
Boryslaw	Rafinerja Olejow Mineralnych Inz. Dr. Baltuch, Lieberman, i Marmelstein	Polish	Old	Purchase	6,000	3,328
Modrycz, near Drohobycz	Modrycka Rafinerja Olejow Mineralnych Gartenberg, Zucker & Ska.,	Polish	Old	Purchase	6,000	Shut Down
Hubicze, near Drohobycz	Hubicka Rafinerja Nafty, Kornhaber, Erdheim, Mendelsohn, Gottesman	Poilsh	Old	Purchase	6,000	423
Kolomyja	J. S. Friedman	Polish	Old	Purchase	6,000	Shut Down
Kleczany	Malopolskie Towarzystwo dla Przemyslu Naftowego, "Kleczany," Spolka z ogr. odp.	Polish	Old	Purchase	6,000	22

Note—Refineries marked (*) include cracking equipment.

(*Continued on next page*)

Location	Company	Nationality	Equipment	Source of Crude Oil	Annual Capacity (Metric Tons)	Crude Oil Run to Stills in Year 1929 (Metric Tons)
Wierbiarz, near Kolomyja	Rafinerja "Wierbiarz" ad Kolomyja, Fabryka Przetworow Olejow Skalnych	Polish	Old	Purchase	6,000	3,697
Krechowice, near Stanislawow	Rafinerja Nafty i Olejow Mineralnych, Lem i Spolka	Ploish	Old	Purchase	6,000	2,702
Boryslaw	Boryslawska Spolka Akcyjna Preztworow Oleju Skalnego	Polish	Old	Purchase	6,000	2,857
Nadworna	Rafinerja Olejow Mineralnych "Segil," Spolka z ogr. odp.	Polish	Old	Own	10,000	7,187
Gorlice	J. P. Madejaki	Polish	Old	Purchase	6,000	Shut Down
Gorlice	S. Tumidajski	Polish	Old	Purchase	6,000	Shut Down
Gorlice	Samuel Ehrenberg & Holender	Polish	Old	Purchase	6,000	Shut Down
Ropica Polska, near Gorlice	Chaskiel Gleicher i Syn.	Polish	Old	Purchase	6,000	219
Drohobycz	Zachiariasz Handel	Polish	Old	Purchase	6,000	Shut Down
Drohobycz	Jakob Aszkenazy	Polish	Old	Purchase	6,000	Shut Down
Drohobycz	"Spogon," (formerly Kreppel)	Polish	Old	Purchase	6,000	Shut Down
Rubicze	Dr. M. Rappaport	Polish	Old	Purchase	6,000	Shut Down
Total					1,468,000 Tons	

Publishing Company, publishers of The Refiner and Natural Gasoline Manufacturer, whose work is the source of much of the discussion presented in this writing, states that the Boryslaw district, which includes the Boryslaw, Mraznica, and Tustanowice fields, is the most important in Poland although one might also mention the Bitkow and Schodnica (Pereprost) fields. The former, which is situated near Stanislawow, is of some interest since, after Boryslaw, it is the only other deep field in the country; and the latter, a shallow field, produces about 750 barrels of oil per day. The Daszawa field, which is of comparatively recent discovery, produces gas at a pressure of about 850 pounds from depths ranging from 1465 to 2500 feet.

The crude produced in the Boryslaw district yields the following products:

Product—	Asphalt Process per cent	Coke Process per cent
Gasoline	12	12
Kerosene	29½	30
Gas Oil	24	25
Lube Oils	10	11
Paraffin	7.4	7.8
Asphalt	8	..
Coke	.	4
Loss and Residuum	9.1	10.2

GASOLINE AND LIQUEFIED PROPANE

Manufacturing methods in the natural gasoline division of the industry in Poland are being modernized to some extent, according to the reports of Mr. Leigh covering that phase of the industry.

"Most of the Polish plants are of the charcoal type," he states, "contructed of European equipment and operated by Polish and French process crews. However, there are a few oil absorption plants equipped with compressors and other units of American manufacture."

This writer also reports gas bearing from 11 to 17 gallons of gasoline per 1000 cubic feet.

One of the leading manufacturers of natural gasoline is the "Gazolina" Spolka Ackyjna with operating headquarters at Lwow. This company owns six natural gasoline plants, including three compression plants, one absorption plant, and one charcoal plant (the latter being inoperative). The company is completing erection of a Newton (Southwestern) process plant at Boryslaw which wil have a gasoline production of 600 tons per month. When this plant is completed several of the older plants will be shut down as obsolete.

"Gazolina" supplies gas to the city of Lwow and manufactures liquefied petroleum gases for the enrichment of manufactured gas. The company is soon to be engaged in the marketing of liquefied gas in tank cars and metal cylinders for use in isolated communities, hotels, institutions and the like.

Societe Francaise des Petroles de "Malopolska," Societe Anonyme, also operates six natural gasoline plants from its operating headquarters at Boryslaw. Four of these plants are located in the Boryslaw district, and two at Bitkow, which produce a total of 13,000 gallons of gasoline daily.

Societe Francaise Des Petroles de "Silva Plana," which operating headquarters at Boryslaw has three gasoline plants operating all of the charcoal absorption type, with an average daily production of 3150 gallons.

Ski. Akc. Standard-Nibel w Polsce (Standard-Noble Company in Poland and a subsidiary of the Standard Oil Company of New Jersey), although for the most part a producing company, operates one charcoal absorption plant in the Boryslaw district, producing 1450 gallons of gasoline daily.

Galicja Galicyjskie Akcyjne T-wo Naft, also at Boryslaw, operates one gasoline plant producing a daily average of 1325 gallons.

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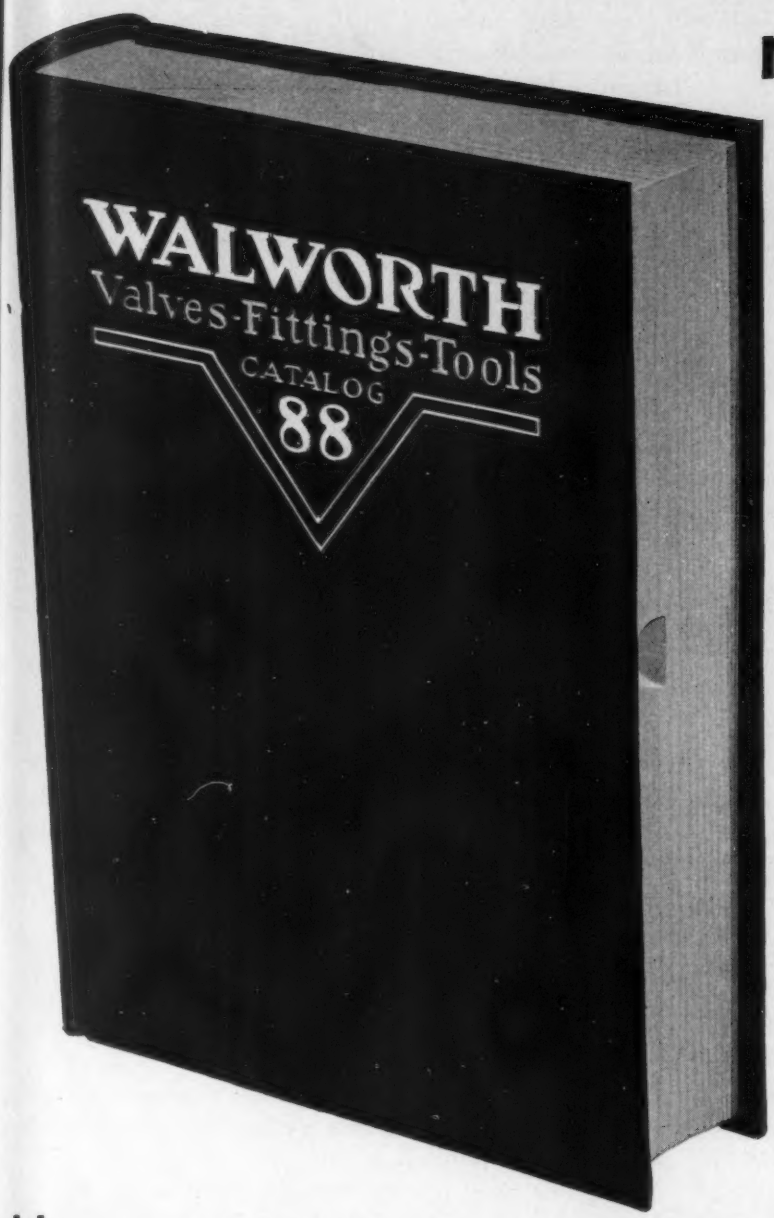

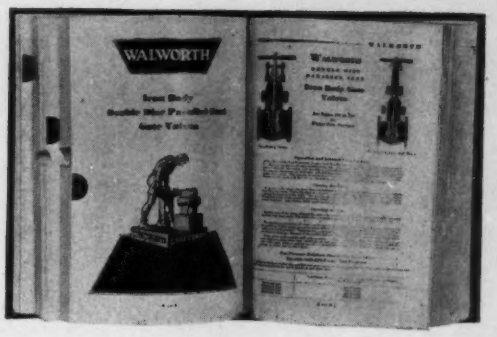

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Cracking Urged as the Answer to Europe's Oil Problems

(*Continued from page* 90)

oil). This product, although containing precious substances which may be extracted through a chemical process, is not in demand at the time being.

"The freight from factory (refinery) to Constantza (the Black Sea shipping port) is higher than the value of the product. The only way to improve the value of paraffin pacura for which the refineries have no further storage space would be to put into operation the special chemical process adapted to it, by all the oil producing companies of the world and even in non-producing countries, the so-called cracking."

It is known by students of world oil conditions that this article does not in any way exaggerate the difficulties of the Rumanian refiners. They are in even worse position than some American refiners, inasmuch as there is no market for their fuel oil, and it is choking refining operations as it continues to accumulate in their limited storage.

After a few sentences in which the editor describes briefly what cracking is, he goes on to say:

"Practically all oil companies in the country which are founded with foreign capital have already introduced the cracking process. Some Rumanian enterprises are also endeavoring to adopt it. A large Rumanian company has computed that at its present production of crude oil, the introduction of the cracking process would furnish it a supplementary profit of over $150,000,000 a year."

The editor then goes on to point out that it was only the development of cracking which made possible the numerous advances in the use of automobiles and railroads, and that cracking has increased the average yield of gasoline from crude oil from 24 to 60 per cent.

Again, the editor says: "At the present moment all our engineers and all oil leaders agree that general adoption of the cracking process is imperative for the Rumanian oil industry.

"There is a difficulty. A cracking installation however small, say for 30 to 40 carloads of paraffin pacura per day, costs a great sum. That part of the industry which is financed with Rumanian capital is unable to make such an investment today.

RUMANIAN INVESTMENT PROFITABLE

"'Foreign capitalists are now fully convinced that an investment in Rumania in cracking installations would be profitable, but they hesitate to make such investments because of excessive taxation. Without a guarantee of reduced taxes and opportunity to make more profits, foreign capital will be hard to induce to invest in cracking in our country."

Here is the remedy proposed for the situation by the editor:

"If the government wants to stretch out a helping hand to the largest Rumanian industry, if it wishes to prevent its destruction, the government should do for the petroleum industry what it strives to accomplish for agriculture, because the present situation cannot last much longer without disaster.

"The government wants to collect millions, in order to insure the profitableness of agricultural labor, by cheap credit. It should consider that the same concern is due to the oil industry, which even at the present crisis brings millions worth of strong currency into the country.

"Agriculture depends on the clemency of heaven. No matter how great the efforts of the man, when it does not rain, or when it rains too much, the crop is lost. From the depths of the earth oil is extracted regardless of seasons. Besides the state participates to an appreciable extent in the profits of the oil industry, another reason why it should contribute to the introduction of cracking."

The extent to which the cracking process is gaining ground in Rumania is indicated by an article recently published in Petroleum Times of London. This article described what it conceived to be probably "the longest continuous cracking run ever made in Europe while processing a fuel oil charging stock."

This run was made at the Campina refinery of the Steaua Romana and continued for 1019 hours, or 42½ days. "The type of operation," the article went on to say, "is known as flashing."

CRACKED 2700 BARRELS DAILY

"Some interesting facts of the run are that 16,990 metric tons—equivalent to 114,800 barrels—at the rate of 2700 barrels a day of oil were cracked, with a total coke production of only three tons. This is less than .02 per cent by weight and shows the degree of control of coke formation that this method of operation has obtained.

"No less than 35 per cent, by volume, of 200°C. (392°F.) end point benzine was produced from a cracking stock consisting of a 90 per cent Rumanian fuel oil residue and 10 per cent cold filtrate blend. This blend had a specific gravity of 0.931.

"Steaua Romana has a modern cracking installation of three large Dubbs units. The carrying out and results of this run, which compare favorably with any obtained in America or elsewhere, are indicative of the progress that is being made in Europe in the operating technique of that important branch of the oil refining industry—cracking."

As is well known, the Spanish government is working out a nationalized oil refining industry, the French government is taking a considerable hand in the oil trade, and in other countries where private interests are installing cracking plants the government is regarding these with an approving eye, if it is not actively backing them with money.

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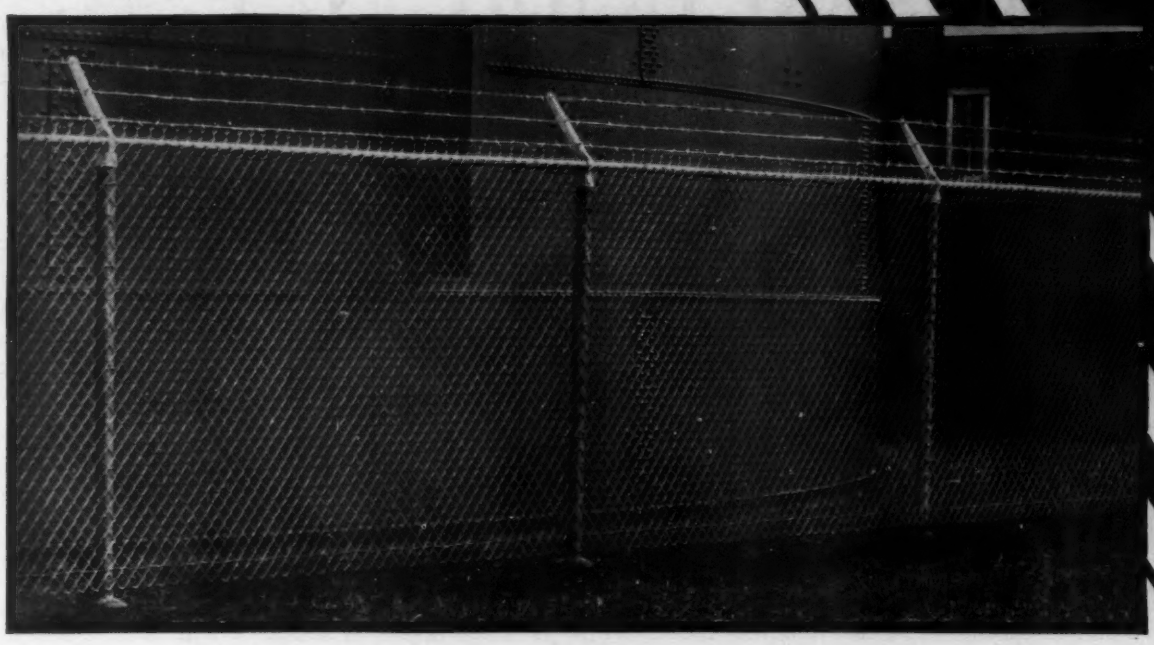

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Hydrogenation Results Discussed Before N. P. A.

NATIONAL Petroleum Association at its twenty-eighth annual convention, Atlantic City, September 17-19, had as the keynotes of its sessions the consideration of such important developments as hydrogenation, marketing of petroleum products, and the influence of the future development of aviation upon the petroleum industry. Hydrogenation, which was covered in a comprehensive and detailed report of the findings and results of the process work, by Dr. R. T. Haslam, manager of the Standard Development Company, who presented the first concrete data based on actual experience with the process in the United States, proved of great interest and value to the membership in attendance.

The discussion of problems of the aviation industry, the development of commercial aviation, and the particular influence of the petroleum industry upon aeronautics, occupied the major portion of the association program and indicated much of farsightedness upon the part of association board of trustees and program committees in the study of a rapidly developing outlet for peroleum products at a time of depression and overproduction. The problems of that phase of the internal combustion engine industry which has taken to wings and the importance of the petroleum refining industry to that growing industry was presented by men well known in "air circles." Captain E. V. Rickenbacker, war-time ace and now vice president of Fokker Aircraft Corporation, now owned by General Motors Corporation and known as General Aircraft Corporation; Colonel Paul Henderson, senior vice president of National Air Transport Company, Incorporated; Colonel Clarence M. Young, assistant secretary of Commerce for Aviation, and Guy M. Vaughan, president of Wright Aeronautical Corporation, presented interesting and valuable papers dealing with various phases of development of air traffic, airplane fuels, and the assistance expected from petroleum refiners.

Discussions dealing with problems current in the refining and marketing phases of the petroleum industry were prepared by Norman D. Day, vice president, the Pennzoil Company of California; Richard B. Kahle, president of Colonial Beacon Oil Company; Joseph E. Pogue, petroleum economist and member of the committee on petroleum economics of the Federal Oil Conservation Board, and Horace L. Lohnes of the Washington office of the association, who discoursed on the oil business and the radio.

Dr. R. T. Haslam, in his discussion of hydrogenation, stated that his talk was placed largely upon showing of the experimental plants which have been in operation by Standard Oil Company of New Jersey and two subsidiaries for the past year or more and not upon the performance of the 5000-barrel commercial unit now operating at Bayway, New Jersey. The complete discussion as presented by Dr. Haslam is presented elsewhere in this issue of THE REFINER AND NATURAL GASOLINE MANUFACTURER.

The speakers on aviation stressed the inevitable growth of this type of transportation. All agreed that in time the aviation industry will become one of the largest customers of the petroleum industry. Automobiles by 1950 were placed at 50,000,000. At present the airplanes in service have flown 100,000 miles on schedule during the past four years. Satisfactory progress is reported in installations of radio stations, beacons, air ports and other ground equipment necessary to the successful performance of the aircraft industry.

IT'S EASIER TO BUY AIRPLANE FUELS

The purchasing of fuel for airplane engines is becoming more simplified. Refiners have familiarized themselves with the needs of the "flying engine" as to fuel and lubricants and are meeting the standard required. As more flying is done, it was pointed out, more petroleum products are consumed, as the aviation industry develops units of ever increasing size and fuel consumption are being employed. The need for definite standards for high grade motor fuel for aircraft and the need for widespread distribution of such fuels are rapidly being met.

Horace L. Lohnes of the Washington office of National Petroleum Association, in his paper, "Oil and the Radio," stressed the need for co-operative action on the part of the industry for the protection of its requirements for the use of valuable short wave bands for communication, and dealt with the necessity for licensing of oil companies for the use of radio equipment in geophysical exploration.

Fayette B. Dow, in the absence of Joseph E. Pogue, read Mr. Pogue's paper on "The High Cost of Gaso-

line," (in storage), in which the pressing need for immediate sharp reduction in gasoline stocks was stressed. In conclusion he stated "Ten million barrels of surplus gasoline in storage is a fair measure of what stands in the way of improved earnings next year. It is probable that the maintenance of this surplus will create a price level two cents a gallon below what would be realized if the surplus is eliminated, and hence the failure to bring about this liquidation would affect the 1931 income of the industry adversely to the tune of $400,000,000. One is justified, therefore, in referring to the high cost of carrying surplus gasoline in storage.

This line of thought was further stressed by Mr. R. B. Kahle's paper, "The Real Marketing Problem," who stated in conclusion: "Why should the manufacturer of gasoline immediately convert all of the crude he can move through his plant into finished product, for which he has no sale at fair prices, not even the possibility of sale? There will be no shortage of crude in our industry for several years to come. Every refiner can secure adequate crude supply. Why, then, accumulate this unnecessary, uneconomical stock of finished products, which, with its ever present pressure on and threat to our market, is the basic cause of our unprofitable business today?"

Herbert Ross, combustion engineer, heading the co-operative engineering work of a group of 13 member companies, spoke briefly on the progress made and the continued savings manifest through the efforts of the members of the co-operative program. Coal consumption is still showing reduction. Coal analysis covering fuel qualities are to be secured more quickly in the future. Also, the co-operative program calls for a study of boiler feed waters used in member refineries.

LYONS' OPENING ADDRESS

E. M. Lyons, in his opening address as president of National Petroleum Association, outlined the progress the association has made in their moves to secure a clarification of the Pennsylvania liquid fuels tax, and spoke of the successful efforts of the association to secure a downward revision in fire insurance rates in Western Pennsylvania. He mentioned several items of accomplishment of the organization during the past year, and dwelt upon the progress that has been made in the training of refinery employes in first aid work and the results achieved by refinery fire marshals in removing and improving hazardous conditions about the plants. In concluding, Mr. Lyons stated that the association would hold its semi-annual convention at Cleveland, Ohio, again in April of 1931.

The annual dinner was held at the Hotel Shelburne, Thursday night, at which time several features were presented, including an informal talk on the subject of fellowship and co-operation by Fayette B. Dow, general counsel for the association. A bronze plaque was presented by R. A. Wotowitch, trustee in charge of safety and fire prevention, to Conewango Refining Company's first aid team, represented by H. R. Lewis, general manager, for that team's victory in the first aid contest held in Cleveland at the time of the spring convention. Thursday afternoon Sinclair Refining Company was host at a luncheon given members of the association at the club house of the Sea View Golf Club. During the afternoon many members accepted the invitation to play golf on the club links.

The board of trustees for the coming year was elected by the association at the time of the opening session. The trustees placed in nomination by the nominating committee consisting of J. P. Flynn, Ohio Valley Refining Company; James Lewis, Bradford Oil Refining Company, and G. B. Hunter, Emlenton Refining Company, were unanimously elected as follows: Fred G. Clark, Conewango Refining Company; Shelden Clark, Sinclair Refining Company; Earle M. Craig, Freedom Oil Works Company; G. C. Davison, Tri State Refining Company; O. D. Donnell, Mid-Kansas Oil & Gas Company; Frank B. Fretter, National Refining Company; T. J. Hilliard, Waverly Oil Works; W. T. Holliday, Standard Oil Company of Ohio; W. V. Hartman, Gulf Refining Company; O. P. Keeney, Keeney Oil Company; H. A. Logan, United Refining Company; E. M. Lyons, Tiona Refining Company; Charles L. Suhr, Pennzoil Oil Company; Otto Koch, Kendall Refining Company; A. W. Scott, Empire Oil Works; C. G. Sheffield, Standard Oil Company (New Jersey); Col. J. H. Graham, Indian Refining Company; P. S. Tarbox, Independent Refining Company; R. A. Wotowitch, Empire Oil & Refining Company; N. H. Weber, Pure Oil Company and A. C. Woodman, Richfield Oil Company of New York.

At the organization meeting of the new board of trustees, the retiring officers were re-elected as follows: president, E. M. Lyons, Tiona Refining Company; vice president, P. S. Tarbox, Independent Refining Company; second vice president, N. H. Weber, Pure Oil Company; general counsel, Fayette B. Dow; traffic attorney, Willis Crane; recording secretary, Herbert G. Eaton; assistant recording secretary, E. W. Smiley; treasurer, G. B. Hunter.

High Cost of Gasoline
(In Storage)

By JOSEPH E. POGUE
Consulting Engineer, New York City

Before the National Petroleum Association Convention, Atlantic City

THE petroleum industry entered the current business depression with large inventories, a tremendous potential overproduction of crude oil, and a refining capacity grossly in excess of even normal requirements. That it has been able to traverse the intricacies of this trying period with only a sacrifice of earning power, but thus far without disaster is suggestive that the oil business is applying economic principles foreign to its older operations.

But the battle is not yet won. Up to the present, the industry has been following defensive tactics. The time has now arrived to take the offensive and the purpose of this talk is to suggest a program which, if followed, should insure for 1931 a reasonable reward to the oil industry.

The petroleum industry has demonstrated that faced with adversity it can hold back the supply of both crude petroleum and gasoline. This is now a fact accomplished and current equilibrium between supply and demand has been attained. With this condition arrived at, there are doubtless some who wonder why the price structure is so weak and where, after all, is the advantage of balancing supply and demand if profitable prices are not immediately forthcoming.

Those who hold to this view are overlooking the existence of an important adverse economic factor, which must be met and solved before a sound statistical condition can prevail and the reward of price improvement may be enjoyed. Reference is had, of course, to the burdensome inventories that now oppress the oil markets.

CAUSED BY OVERPRODUCTION

These inventories are the accumulative result of overproduction in the past and these excesses logically constitute the problem to which the industry should now address itself. Fortunately the idea is gaining ground in the industry that excessive inventories constitute an economic liability.

On July 31, 1930, there were 687,000,000 barrels of oil in storage in the United States; probably twice the volume needed for working stocks. Of this quantity, 524,000,000 barrels was crude oil, while 163,000,000 barrels were petroleum products. Of the latter, 46,000,000 barrels was gasoline. And of this quantity of gasoline, 10,000,000 barrels may be regarded as the price-breaking excess above liberal working stocks.

Now, as gasoline is the money crop in the oil business, it may be concluded that it is this 10,000,000 barrels of surplus gasoline that is preventing the industry from benefitting constructively from its accomplishment in balancing current supply and demand—that is, indeed, threatening a prolongation of the depression in which the industry finds itself.

If this be the case, then the question arises: Why not liquidate this surplus? That is precisely what the constructive thought in the industry is advocating and what every member of the industry, whether producer or refiner, should seek to bring about.

Unfortunately, this objective is not easy of attainment. One reason is that the normal growth in the demand for gasoline, already in process of decelerating (in this country, at least), is further retarded by the business depression which is gripping the entire world. In 1929, the demand for gasoline enjoyed a rate of increase of 13.5 per cent; during the first nine months of 1930, this rate had fallen to 8.9 per cent; while during the summer, the rate has dropped to around three per cent or so. This circumstance is a serious matter, for the country is involved in no ordinary depression and its duration cannot yet be clearly foreseen.

CARRY-OVER OFF 10,000,000 BARRELS

On the basis of the argument given above, we will set up the objective that on April 1, 1931, the carry-over of gasoline should be 10,000,000 barrels less than the carry-over into the spring of 1930—that is, stocks of gasoline should be 45,200,000 barrels, instead of 55,200,000 barrels, the level on April 1 last.

April 1 next is specified because it will be difficult to bring about the desired liquidation before that time and also because the size of gasoline stocks on April 1 sets the tempo of the gasoline market for the entire ensuing season.

What must be done to bring about a liquidation of the spring carry-over depends upon demand and the adjustment of supply thereto. The gasoline demand is inelastic; that is, it is not susceptible to material increase through a lowering of prices; it is therefore beyond the control of the industry.

The supply of gasoline, however, is what the indus-

try elects to produce and hence is subject to control. (It is also elastic and quite sensitive to changes in price.)

Unfortunately we do not know what the demand for gasoline is going to be between July 31, 1930 and April 1, 1931; but we do know that it is influenced by the business depression and is going to be disappointing. We can certainly not expect it to be as good, relatively, as during the first seven months of this year; we know it has been, relatively, extremely bad during the summer.

Let us, therefore, approach the problem by taking two datum points—the July (1930) rate of supply and the desired carry-over for next spring—and observe what the results will be under varying degrees of increase in demand. This is done in Table 1. It is there seen that with no increase in demand, the July rate of supply will result in stocks April 1 next of 67,700,000 barrels, an increase in the carry-over of 12,500,000 barrels. Such an outcome of course would spell disaster for the industry.

Looking at the table further, it will be observed that a four per cent increase in demand will be required to break even on the carry-over and an eight per cent increase in demand will be necessary to reduce the carry-over to the desired degree of 10,000,000 barrels.

MUCH DEPENDS ON DEMAND

It is apparent, therefore, how very dependent the immediate fortunes of the oil industry are upon relatively small variations in demand. Unfortunately, under conditions now prevailing, there is no way in which an accurate estimate of gasoline consumption may be arrived at. That it will be relatively low is practically assured. The industry should view this factor realistically. It will doubtless lie somewhere between nothing and eight per cent, and will probably run above rather than below the dividing line between the two.

If the demand factor should be six per cent, say, then the July rate of gasoline supply is too high for correcting the carry-over by April; an additional curtailment of 1.6 per cent from the July rate of supply would have to be made. If this additional curtailment were to be concentrated in the item of domestic crude run to stills, then the runs would have to be reduced 84,000 barrels daily below the July runs, or to 2,453,000 barrels per day and this level adhered to without increase until April 1, 1931.

It is not necessary, however, to know what gasoline demand is going to be, in order to correct the gasoline situation, or to lay out a program for that objective. With gasoline stocks at 46,100,000 barrels on July 31, 1930, and a level of 45,200,000 barrels the objective for April 1, 1931, it is possible to calculate what stocks should be each intervening month in order to register steady progress toward the objective. Table 2 gives the results of such a calculation and sets forth a deadline which, if not exceeded, will bring about a correction of the statistical position of gasoline by April 1 of next year.

LOW PRICE LEVEL DESIRABLE

Inasmuch as the supply of gasoline is elastic (i.e. responsive to price), the desired objective will be more readily reached under a low price level. Present unfavorable price levels therefore should be regarded as advantageous to this end. Any tendency to peg prices above their natural levels, or to advance prices prematurely would be harmful to the sound correction of the situation.

In conclusion, it cannot be emphasized too strongly that gasoline stocks must be liquidated substantially, if 1931 is to be at all a favorable year. At the same time, it may be pointed out that this goal is within reach of the industry, if every refiner becomes imbued with this idea and is determined that in no month up to next April shall gasoline stocks be permitted to exceed the levels shown in Table 2.

Ten million barrels of surplus gasoline in storage is a fair measure of what stands in the way of improved earnings next year. It is probable that the maintenance of this surplus will create a price level two cents a gallon below what would be realized if the surplus is eliminated, and hence the failure to bring about this liquidation would affect the 1931 income of the industry adversely to the tune of $400,000,000. One is justified, therefore, in referring to the high cost of carrying surplus gasoline in storage.

TABLE 1

Effect on the Gasoline Carry-Over of April 1, 1931, of Maintaining the July Rate of Gasoline Supply at Varying Rates of Increase in Demand

Period covered: August 1930 to March 1931, inclusive
(Figures in Millions of Barrels)

Per Cent Increase in Demand	Actual Demand	Supply at July 1930 rate	Change in Stocks	Stocks July 31, 1930	Stocks Mar. 31, 1931	Actual Stocks Mar. 31, 1930	Change in carry-over April 1, 1931 from Apr. 1, 1930
0	290.4	312.0	+21.6	46.1	67.7	55.2	+12.5
2	296.2	312.0	+15.8	46.1	61.9	55.2	+ 6.7
4	302.0	312.0	+10.0	46.1	56.1	55.2	+ 0.9
6	307.8	312.0	+ 4.2	46.1	50.3	55.2	— 4.9
8	313.6	312.0	— 1.6	46.1	44.5	55.2	—10.7
10	319.4	312.0	— 7.4	46.1	38.7	55.2	—16.5

TABLE 2

Proposed Course of Gasoline Stocks by Months from August 1930 to March 1931, to Insure a Correction of the Statistical Position of Gasoline by April 1, 1931

(In Millions of Barrels)

1930—July	46.1	a
August	39.2	
September	37.4	
October	36.2	
November	37.6	
December	39.7	
1931—January	43.2	
February	44.5	
March	45.2	b

a—Actual stocks at refineries on July 31, 1930.
b—Desired objective on April 1, 1931. Stocks of gasoline on April 1, 1930, were 55,200,000 barrels.

Transportation by Land, Water and Air

By E. V. RICKENBACKER

Before National Petroleum Association's annual meeting, Atlantic City, September 17, 1930

IN less than a generation, we must expect inprovements in transportation by the highways, by water, and by air far beyond anything dreamed by the general public.

Features of these improvements as they will be developed by 1950 can be noted. The year 1950 is only 20 years ahead of us. To look back 20 years to 1910 is but as yesterday, yet mighty developments have been accomplished in that time. Because of them, the next 20 years will move ten times as fast.

In 1950 there will be 50,000,000 automobiles in the United States. This may seem, at first glance, a brazen claim. Considered a moment, it becomes well nigh a certainty.

In 1910, there were less than 500,000 cars in America. In the intervening 18 years we have built and sold 32,000,000 cars. In 1915 we owned 2,300,000 cars and in 13 years, have sold 29,000,000.

In 1910 a leader in the automotive industry prophesied to a meeting of car manufacturers that the day would come when we would build 500,000 cars a year in this country. Today we are building 5,000,000 cars a year.

Evidently prophecy cannot be extravagant in talking about transportation. A development much slower than we have seen in the present decade will carry us far past 50,000,000 cars before 1950.

Already, in California, which is the most completely roadized state in the union, there is a car to every 1⅞ persons in the state.

California started 20 years ago to build a road system. In this way it has opened thousands of square miles which had been dormant. By opening this land to settlement the roads multiplied its value, multiplied its earning power, multiplied its purchasing power, and thereby made possible the ownership of many things including vast numbers of motor cars.

This experience in one state shows the possibilities of the others as roads are developed.

Population meanwhile is increasing at a rapid rate. New people have been added to our population at the rate of 1,750,000 a year for the past eight years and the rate of increase tends constantly to accelerate.

At a conservative estimate, we will have 150,000,000 people in the United States in 1950. To distribute 50,000,000 cars among them supplies one for each three people, as against the ratio of one for each 1⅞ people already existing in California. In fact, California is today on the basis of 65,000,000 cars for the United States.

SUPER-HIGHWAY SYSTEMS

This vast number of motor cars will travel on a net work of superhighways 300 to 400 feet wide, extending from ocean to ocean and from border to border. They will be straight roads with four lanes of travel, divided into through and local traffic. These highways will not enter the cities, because merchants will not want the congestion of through traffic brought into the city streets. Instead, the cities will be tied into the local lanes by branch highways.

The superhighways will have no grade crossings and no obstructions of any kind. Upon them cars will travel at speeds of 75, 80, 90 miles an hour more safely than we travel 65 to 70 miles an hour today.

The speeds which we attain today are possible only by a number of factors.

Among these are the design of cars resulting in ability for high speeds and in a low center of gravity —the development of four-wheel brakes — improvement in metallurgy giving stronger, tougher steels at lower weights—better tires—better bearings—better roads—better mentality behind the steering wheel.

With these improvements going on, higher speeds with greater safety come about automatically.

Congestion in city streets even with 50,000,000 cars in service is likely to be less troublesome than at present, due to the development of garages in the hearts of the cities. These will be impressive buildings with beautiful shops on the ground floors and storage space for many cars.

A dollar invested in a garage in the traffic centers of our cities pays a better return than in office buildings, hotels, or department stores. In fact the office building, hotel and department store of the future will have garages in connection. It will be possible to drive up to the proper floor, park the car there, walk to the office, and return the same way. Cars will thus be off the streets and traffic will move more easily, more swiftly, with 50,000,000 cars in service than it does today.

Only one-third of the country is contacted with

$160,000 SPENT to help your Engineers SAVE your Money

WHENEVER you require a reducing valve, pressure regulator or other device for controlling the flow of steam, gas, air, oil, etc., you can now be certain that the specialty you select is the one most economical for your purposes . . . because Fisher has spent $160,000 to accurately determine by *actual test* the capacities of all types and sizes of these specialties.

When Fisher realized that the theoretical ratings in general use were, in many cases, causing the users of fluid control equipment unnecessary expense, it was decided to prepare capacity charts that would be accurate—and not merely approximations. This necessitated the building of a new laboratory, and the development of a skilled research organization. Then came many months of careful testing.

These capacity charts are now saving money in three ways for many users of Fisher specialties: (1) reduced initial cost due to the elimination of oversizing, (2) more accurate control because valve works near its capacity, and (3) longer life because the inner valve in "floating" eliminates the possibility of cutting.

Fisher Capacity Charts for steam, air, gas and liquids are now available to all users of Fisher Specialties. They will gladly be sent on request.

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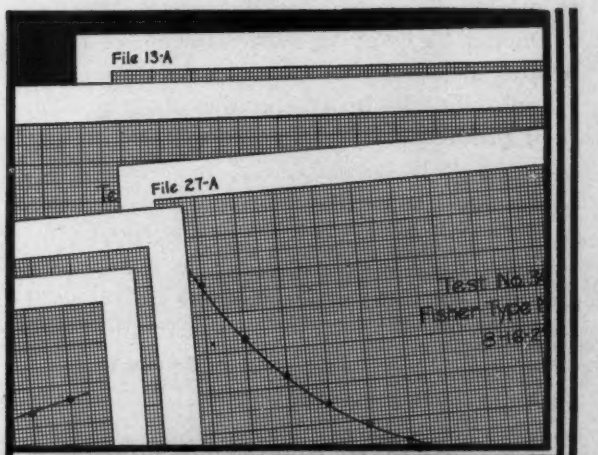

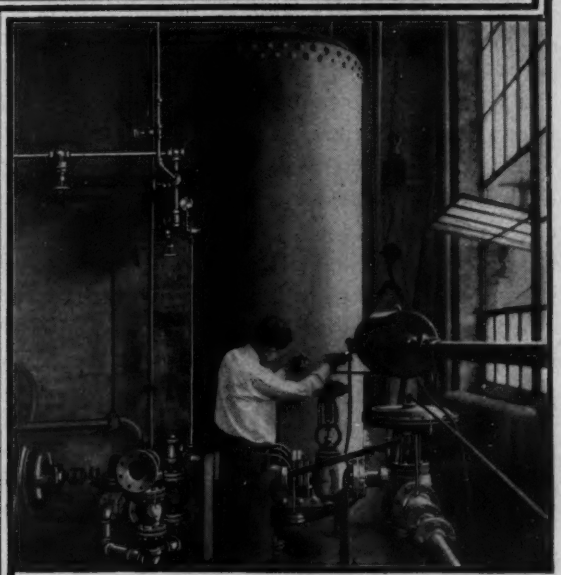

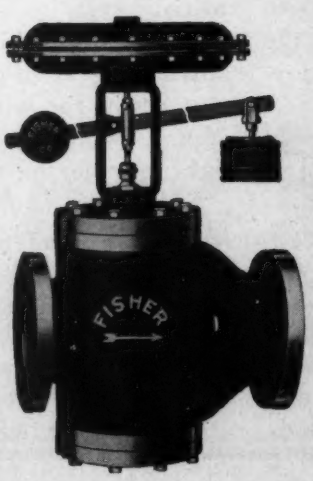

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FISHER
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today by modern transportation of any kind. The rest needs only people and transportation to develop rapidly.

Civilization depends upon transportation and communication. Where you find them, you find prosperity, health, happiness, and contentment. Where they are lacking you find poverty, misery, disease, and unrest.

The railroads will not be harmed in the least by this development of motor transport, but will rather be benefitted by it. The automobile and motor truck are developing territory at minimum expense. There are many fertile valleys in this country inaccessible to the railroads which are now lying dormant and valueless, which the coming of highways would open to world commerce.

Once a highway is built into one of these valleys people settle in it. Buses take their children to school. Trucks bring supplies to them and haul their products out to the markets of the world. All that the railways have lost to the motor truck in short haul business is more than made up for them in the vastly increased volume of traffic.

Under present arrangements, every highway is but an extended right of way for the railroad. Through routes by truck and train with one bill of lading open every station on every railway to the man who has a highway past his door.

CARS IN OCEAN TRANSPORT

Water transportation is benefitted directly and indirectly by automotive developments. Today privately-owned automobiles are a sizeable factor in ocean freight traffic. Five years ago the City of Paris of the French Line started to haul cars on one deck. In the intervening years 30,000 cars have been driven overseas, and many lines now offer this service. The owner merely drives aboard and has his baggage carried to his stateroom. On his arrival in Europe, he drives his car on to the dock and within a few hours is on his way.

A new highway recently completed from Portland, Maine, to Key West is extended by this same sort of ship service to Havana. The day is not far distant when the car owner can go from port to port anywhere in the world with his car, and this service will be used because the car adds greatly to the pleasure in a trip. It is as necessary to full enjoyment as is the trunk.

Other countries are just beginning to build good roads now as we started 15 years ago. Canada is spending more money on its roads in proportion to its population than we are in the United States. They appreciate the American tourist who last year was their biggest industry, bringing $500,000,000 into the Dominion. Mexico, too, realizes that tourists and settlers will come once the roads are in condition for them. It will soon be possible to enjoy Mexico and Central America in winter just as we enjoy Canada in summer. And the day is coming when it will be possible to encircle the entire South American Continent on a system of super-highways.

All this means that vast numbers of cars will be in use—will be worn out—will be replaced. All of which makes for industry and prosperity.

The aircraft industry also is a help to motor cars, railroads and ocean traffic.

Men wonder today whether they will live long enough to see the day of airplanes. As a matter of cold fact, that day is here now and we hardly realize it.

We travel more commercial miles by air in this country than in all the rest of the world combined, covering 100,000 miles every 24 hours—a figure that will be doubled within three years.

Development of air transport will also do its part to open vast areas of territory now unsettled. Such development requires no right of way if done by air. Tracks and highways are not needed. Only terminal facilities are required and these necessitate only a relatively modest investment.

Ten per cent of the annual maintenance cost of good roads in the United States would supply a fully equipped airport, one mile square, for every town of 500 population or more in the country.

RAILROADS TO USE PLANES

Railroads will use the airplane. They lost short haul business by neglecting the bus in its early day, and they are not going to lose passenger travel, mail, express, parcel post, and light freight to the airplane. This sort of traffic will normally go through the air and would make up the biggest transportation industry in the world. The railroads see the possibility and are intent upon developing it.

One feature of their plans is the combination of Pullman and plane service for cross country travel. The New York Central will haul passengers to Cleveland at night and in turn distribute them to air transport systems who will carry them 1000 to 1500 miles further before evening, where they can take a train and the following evening be on the Pacific Coast.

The Pennsylvania with its interest in the T. A. T. is operating a regular 48-hour service by air and rail to California.

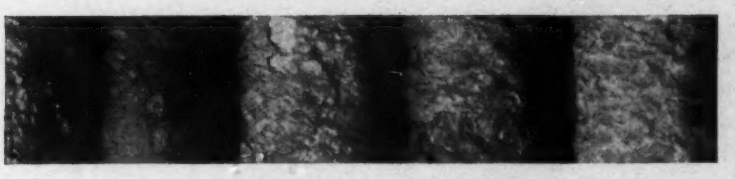
With the combination of T. A. T. and Western Air Express, two of the largest and most successful systems in the world, we will soon have a 36-hour service from New York to California by flying daylight only, laying over at Kansas City one night.

Before 1931 is out, we will have eliminated the rail combination, and will be flying direct from New York to the Pacific Coast in 20 to 26 hours. These planes will have sleeping quarters, dining salons and all requisite travel comforts.

In those days, all rail lines will be paralleled by air lines under the same management.

Traffic is the railroad companies' business and they

Close-up view of a B & W *Seamless* NIROSTA KA2 Tube in a condenser bundle



THIS unretouched photo of a condenser bundle was taken in a prominent refinery. Cooling water passes through the tubes, gasoline vapor on the outside.

All the tubes shown have been in service for the same length of time. The four tubes which have been badly attacked are steel tubes, whereas, the tube indicated by the arrow is B & W NIROSTA KA2.

NOTE: Spots shown on the NIROSTA KA2 tube are not pitting, but simply discoloration from rust from the surrounding steel tubes.

THE BABCOCK & WILCOX TUBE COMPANY

85 LIBERTY STREET NEW YORK, N.Y.

are also awake to the possibilities that they are not going to let new men take it away from them. They will build their own systems and compete with newcomers or will buy them out.

It may safely be predicted that passenger trains will pass out of use within 15 years. Long hauls will be covered by air, short hauls by private cars and by public buses.

Railroad yards will be decked over and utilized as landing fields so that planes can alight in the hearts of the cities. Railroad traffic, in the meanwhile, will be handled by electric locomotives on the lower levels.

These changes will come about because time demands them. Time cannot be saved up and used as needed in the future. It must be used now if at all, and the man who uses it most effectively takes all the advantage in the commercial competition of today.

That competition is pitiless—far more so than in military combat where all the resources of science are marshalled to the help of the injured. In commercial warfare, the man is drowned who does not make the most effective possible use of his time.

BIGGER PLANES TO COME

The present transport plane is as obsolete as a five-year-old car, cruising speeds of 150 miles to 200 miles an hour for transport planes are perfectly feasible. With such planes the Pacific Ocean, in hours of travel, would be brought as close to New York as Detroit is now, and Detroit would be three hours from New York, instead of the 14 hours required by the fastest trains.

Air transport, would thus, in effect, reduce the size of the United States to the size of the state of Texas. The fastest train across Texas requires 24 hours. At an evarage speed of 150 miles a plane crosses the continent in shorter time.

It is very difficult to conceive of speed in terms of the future. The Spad plane as used by me during the World War, traveled 125 miles an hour and was the fastest thing in the world. Single seater planes have been built capable of 350 miles an hour. It is only a matter of engineering to build a plane to go 500 miles an hour, and someone will do it somewhere on earth within three years.

Big as present planes are, they are mere kites in comparison to the ones to be used in future. The biggest thing we know of on earth is the ocean of air in which our earth floats. No one has ever conceived how vast this ocean is, and upon it every city and town is a port.

The possible size for a plane or dirigible is therefore limitless, and we must expect them to increase largely in size because the ratio of pay load increases with the size of the unit. Size is now merely the control of an engineering problem.

We are about to witness the crossing of the Atlantic by the German DOX, which has already taken into the air 169 people, and will accommodate 75 to 100 passengers on short hauls and regular service. It is powered with 12 engines of 600 horsepower each giving a total of 7200 horsepower and will fly with full load on any seven of these engines.

Cruising radius is merely a matter of supplies. When planes and dirigibles can carry reserve supplies of oil and fuel, they can go anywhere. Under present conditions, they must go straight ahead on their course. If ocean vessels had to operate the same way, they would lose 15 per cent to 20 per cent of its shipping every year through storms. But ships go around the storm or lay by until the weather ahead has cleared. Very soon aircraft will do the same.

In fact, the Graf Zeppelin abundantly proved the value of cruising radius in crossing to Lakehurst. It traveled far south to avoid a storm, was delayed a full day, yet arrived after 6000 miles with 65 hours of fuel still in the tanks.

The Graf Zeppelin with its 3,600,000 cubic feet capacity is now the biggest dirigible in the world. But the United States government has signed a contract with Goodyear Tire and Rubber Company for two dirigibles of 6,500,000 cubic feet capacity—a 100 per cent increase in size between models.

England has built two dirigibles of 5,000,000 cubic feet, one of which recently crossed the Atlantic and returned. For regular transport service, these dirigibles are equipped with dining rooms, dance floors, promenade decks, shower baths for the passengers.

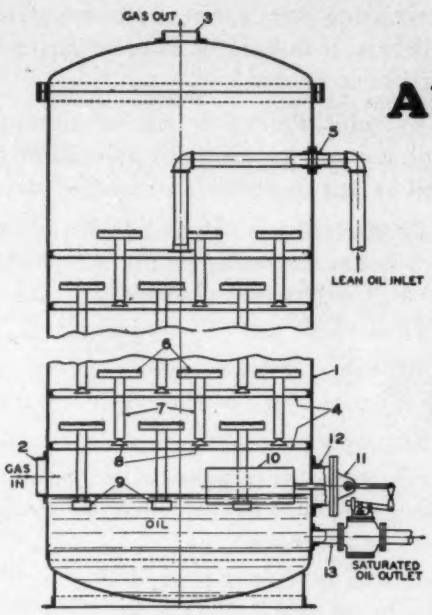
One of these will go into passenger, mail, and express service between London and Sydney, Australia, going always from west to east with the prevailing winds and thus encircling the globe on each round trip. The other is expected to go into service between London and Buenos Aires. This trip, which now requires 30 days by the fastest boat connections, will then be made in 3½ days.

Dirigibles can be built to any size and may eventually be a mile in length and of 25,000,000 to 30,000,000 cubic feet capacity. Such ships would be capable of staying in the air five or even 10 years, making repairs en route and taking on new supplies without stopping. Landing one of them would be too complicated a process to be profitable at short intervals.

The dirigible would therefore go continuously on its way around the world. As it approached a city another ship would go out to meet it and dock on its decks. It would unload supplies, exchange cargoes and passengers, and possibly relieve the crew, then take off again and return to its home city.

It is worthy of note that the airplane would be largely useless without the automobile. No one

Billions of Bubbles



Look Into This Absorption Question

THE very heart of a natural gasoline plant is its absorption equipment. There can be no temporizing in the choice of absorbers. Your absorber is either an asset or a liability; there's no half-way ground.

If you are not getting maximum absorption, you are paying tribute to that most heartless of all racketeers, Old Man Inefficiency.

The Campbell "Oil-Froth" absorber, because of awarded superiority in test after test, has won an enviable reputation for efficiency. It is as natural for the operator to specify "Oil-Froth" absorbers as it is for the church architect to specify Tiffany windows.

Look into this absorption question.

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would use aircraft if he had to travel by horse and buggy from the airport to the heart of the city. There must be cars at both ends of the airline which increases the use of cars and means increased business for car companies.

TASK FOR YOUNGER GENERATION

Private ownership of planes is coming through the keen interest of the younger generation. The motor car was developed in precisely the same way. It was commercialized by the generation succeeding the one which created it. Older men have responsibilities which restrain them from developing the new to its utmost extent. The youngsters, who grow up with it, make full use of it.

Twenty-five years ago the social radius was five miles and the commercial radius not to exceed 10 miles. The automobile extended the social radius to 25 miles and the truck increased the commercial radius, at a very conservative estimate, to 50 miles. Now aircraft extends these limits to 75, to 100, 150 miles and puts cars to work at both ends of the line.

These amazing developments in transportation are equalled, if not even surpassed, by improvements in communicating ideas.

Here radio and television are supreme. So rapidly are they being developed that very soon important advertisements will be dispatched by television to the newspapers of the country the night before insertion. Last winter an advertisement of a bond issue was televisioned across the ocean to Paris and was on the streets there within three hours of its release in New York.

Three days before last Easter, a milliner in New York received from Paris a television showing in colors a new hat, copied it in his designing department, and had it on sale within three hours of its showing in Paris.

A modiste in Los Angeles must now send buyers to the New York or Paris markets where they try to buy to supply a future Los Angeles demand. In the future they will buy immediately in Los Angeles by television showing and radio.

They will call their clientele to sit before the screen and see a New York fashion show, hear the actual descriptions by radio, and make their own selections. There will then be no obsolescence of goods on the shelves, no cut-price sales to move goods that have passed out of fashion, no economic loss through failure of turnover, bad judgment in buying, slow transportation and slow communication.

It is only a matter of time when goods so examined in Los Angeles and ordered by radio on the same day will be shipped from New York on the night air express, delivered in California the following afternoon and worn at a dinner dance or ball in the evening.

REVOLUTIONIZING CREDIT STRUCTURE

Money has been transferred across the Atlantic by television. When this process is perfected, the entire financial and credit structure will be revolutionized. Billions of dollars are constantly in transit, during which time they have no earning power, no purchasing power, but are a complete economic loss. Millions of dollars of interest charged for them is a further economic loss.

By selective registration of signatures this money will soon go by air or by television, and these losses will be cut to seconds instead of days.

Banks will have their television department which will be as essential as the telephone today. Great savings will thereby be effected. The dollar is hardly well at work now.

All these changes will, in effect, reduce the world to about the size of the United States today.

It is the clear obligation of the present generation to develop these possibilities nationally and internationally and devote them to world understanding and world peace.

We have already proved what a wealth of good will can be gained from transportation and communication by our glorious apostle of youth—Lindbergh. We should send a thousand Lindberghs every day with messages of good will and with merchandise. A better world wide understanding will result, and will eliminate the jealousies, intrigue and envy that have caused wars.

We must do it before the next generation comes to manhood and womanhood. We must turn all these mighty forces to the service of mankind. We can no longer afford to learn our lessons through mistakes called wars.

If we fail to do it, civilization is in jeopardy. When wars are fought in the air, there will be no "No Man's Land" but every man's housetop will be the front. There will be no non-combatants in future wars.

Every man, every woman, animal life, vegetable life, even the fertility of the soil will be among the combatant forces. Gases are already in readiness that will destroy all these.

Aircraft of today will carry bombs of 5000 pounds. They can be built to carry them of 10,000 pounds, 20,000 pounds—large enough to lay waste whole city areas, wrecking the buildings and destroying the people.

It is possible for planes to use giant burning lenses weighing tons with which they could focus the rays of the sun upon a city and melt it.

These deadly weapons could thus be used for the destruction of mankind, but they need not be so used. It is the part of wisdom to turn them into economic blessings and angels of peace.

G-R Bentube Sections

From 1 to 822 units used by 159 plants

MANY users of G-R Bentube Atmospheric Cooling Sections have standardized on them because of their exclusive scale-shedding feature, which prevents scale from building up, no matter how poor the cooling water may be.

Others use these sections for various condensing and cooling services because of their adaptability and ease of erection, dismantling and transportation, which permits them to be moved about the plant as required by operating conditions.

Still others find their compactness and effectiveness an important aid in minimizing the space required for installation, permitting small basin area under cooling towers and small tanks for submerged operation.

These are some of the important advantages that explain the rapidly increasing use of G-R Bentube Sections.

If you are not now securing the benefits of this unique apparatus in your condensing and cooling processes, write for bulletins describing these sections.

The G-R Bentube Section is patented and it is our intention to prosecute all infringements. Suits, charging infringement of our patent No. 1,617,083, have been brought in the U. S. District Courts at Wilmington, Delaware, and New York, N. Y.

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CONDENSERS
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INTERNATIONAL PETROLEUM EXPOSITION

Every one of our factory representatives is equipped with a Pyro Radiation Pyrometer which gives instant, accurate reading of the temperature in any or all parts of the furnace.

Booth 57

REFINERS' AND MARKETERS' BUILDING

Get The Answers To Your Refractories Questions

As every refinery official knows, operating conditions vary with each refinery. The type of still or boiler setting, the fuel employed, temperatures, and many other variables influence the service obtained from refractories.

What refractory cement will serve most efficiently in each condition? This question, and any other refractories problems you may have, will be welcome in Booth No. 57 in the Refiners' and Marketers' Building.

ADAPRODUCTS representatives from every section of the country will be there and will be glad to discuss your refractories problems with you. They are fully familiar with refractories requirements in refineries in every district. They can be of genuine assistance to those interested in improving the service life of fire brick construction.

Remember, too, that the counsel of ADAPRODUCTS representatives is unbiased, for they have available, in ADAMANT Fire Brick Cement and other ADAPRODUCTS, a complete line of refractory cements and materials, which, alone or in combination, fulfill practically every individual need.

If you are unable to attend the Tulsa Exposition, we shall be glad to send you complete data on ADAMANT Fire Brick Cement and other ADAPRODUCTS. Write us.

BOTFIELD REFRACTORIES COMPANY

World's Largest Exclusive Manufacturer of High Temperature Cements

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Other ADAPRODUCTS *Include*

ADACHROME *Plastic Super-Cement* ADACHROME *Fines* ADACHROME *Aggregate*

ADAPATCH (fire brick in plastic form) The ADAMANT Gun

Write for booklet

PLANT MEN AND METHODS

By GEORGE REID

Swanson Made Chief Economist

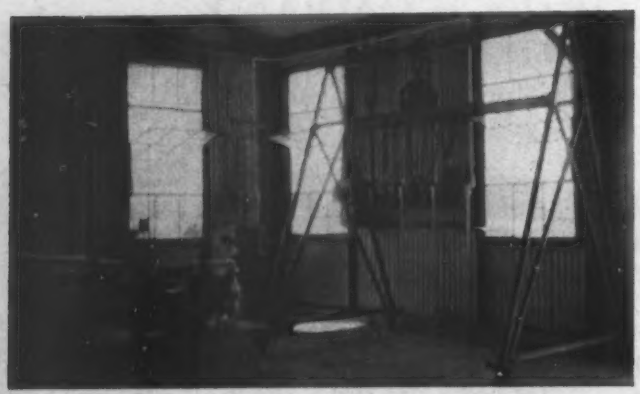
The appointment of E. B. Swanson as chief economist of the division of petroleum economics of the United States Bureau of Mines, was announced by Scott Turner, director of the Bureau, September 11. Mr. Swanson has been serving as acting chief of the division since October, 1928. He is a graduate of the University of Washington and did graduate work in economics at the Robert Bookings Graduate School in Washington, D. C. Other recent personnel changes in the petroleum economics division of the bureau include the promotion of G. R. Hopkins from associate petroleum economist to economic analyst and of A. H. Redfield from assistant scientist to associate economic analyst.

The petroleum economics division was established as a unit in the economics branch of the Bureau of Mines on January 1, 1926, at which time H. H. Hill, chief engineer of the petroleum and natural gas division of the technologic branch, was designated to serve as chief of the petroleum economics division during its formative period.

Future work of the petroleum economics division will include additional studies of the distribution and utilization of petroleum products, according to C. P. White, chief of the economics branch of the bureau.

For Handling Heavy Materials

A novel idea in facilitating repair work by means of a portable hay-frame type of crane. By means of this rolling piece of equipment plant operators or repair men at Humble Oil & Refining Company's Sugar Land, Texas repressuring plant are enabled to move with ease heavy machinery parts from the engine under repair, to the work bench. The frame is made of two-inch scrap pipe welded as shown in the illustration. The block and tackle are placed in a central position suspended on the upper beam. It is designed to be of proper length to fit between two compressor machines with sufficient clearance above to lift any of the heavy parts cient clearance above to lift any of the heavy parts of the machines clear of all obstruction. The part needing repair is rolled out of the way and to another part of the building where workmen make the required changes. Where repairs of a major nature are required a spare peice is carried in stock which can be suspended in the frame and rolled into position easily. The light crane is simple in construction and inexpensive in fabrication. It fits into one corner of the building when not in service and requires but little space for its storage. By its use all heavy and hazardous lifting is eliminated in the compression plant.



Welded Repair Crane

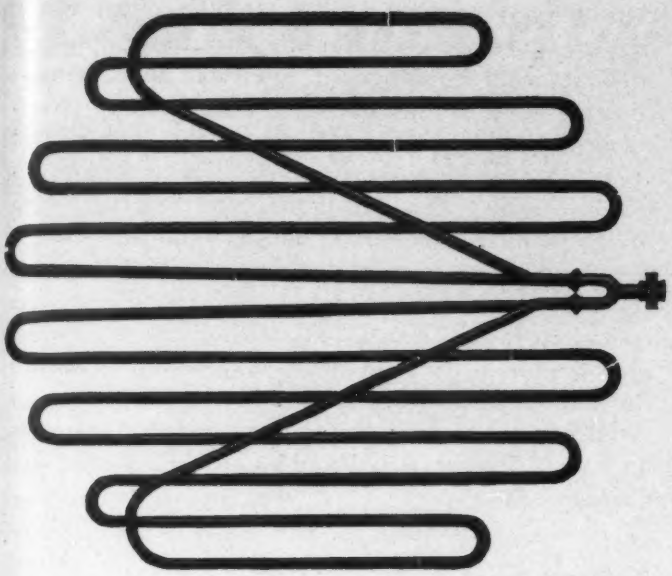
Book on Hydrogenation . . . . .

Carlton Ellis has completed his book on Hydrogenation and the volume will be ready for distribution early this month, according to advices from D. Van Nostrand Company, publishers. Prepublication descriptive matter states that Mr. Ellis has started with a clear account of the principles of hydrogenation catalysis and systematically covered the scientific work on the hydrogenation of individual organic compounds and exhaustively presenting details of the industries themselves.

In this volume all of the known information about hydrogenation is given and a wealth of new material that has never been published before. The design of equipment is discussed and the operation of every process is adequately described.

The book deals with fundamentals of catalysis, mechanism, poisons and inhibitors, promoters and co-catalysts, experimental apparatus, and all types of catalytic substances. Hydrogen production methods are presented. A comprehensive review of hydrogenation and related patents is offered. Hydrogenation of fatty oils, experimental, analytical methods and data, industrial practice, is given since much knowledge has been gained by such developments in other industries.

The twelve closing chapters of the book deal specifically with various means of hydrogenation of petroleum. In these pages the author describes the patents, investigations, and the details of prepara-



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Air-pressure tested while submerged in water. Proved secure, then serially numbered and tagged. A Pittsburgh-built Coil is an air-pressure tested Coil.

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All sizes up to and including six-inch. Furnished with steel protectors to safeguard the threads.

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UNION

Reversible Load Sprocket, an exclusive feature, insures twice the durability of the usual hoist construction. Large roller bearings reduce friction to a minimum. Efficient steel cut gears permit loads to be lifted with minimum overhauling of chain.

Shaft and pinion gearing are supported beyond the intermediate gears, for greater strength and rigidity. The chain is electric welded and tested, and hooks are made of forged steel. Altogether, Union Hoists have *fifteen* special features.

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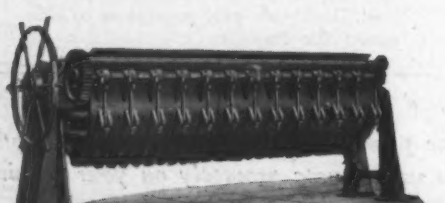
HOISTS



Five More Sweetlands and Three "Blotter" Presses

One of the largest refineries on the Atlantic Coast recently ordered five large Sweetland Pressure Filters for contact work and three "blotter" presses for final clarification.

Oliver United provided both types of filters.

OLIVER UNITED FILTERS INC.

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tion of many successful catalysts. Excellent working directions are given for the operation of various processes and the design of equipment used. Analytical methods are described and chemical and physical principles upon which the operation and control of the processes are based, are explained. An appendix has been added during the past few weeks to bring the data contained in the book up to the minute, discussing latest developments in the hydrogenation of carbonaceous materials, carbon monoxide and petroleum. Throughout its thousand pages the book promises to be of great interest and value to those interested in synthesis and the production of petroleum products by hydrogenation processes. This book may be secured through the Gulf Publishing Company.

Source of Gasoline

The discussion of source of gasoline often comes up in the work of the refinery operator. Questions are often asked concerning what percentage of total gasoline production is straight-run, cracked, or natural gasoline. The accompanying Table 1 is provided in answer to these questions and covers a period of the last five years, the first six months of this year, and the month of June, 1930.

The second table shows the answer to that other question—what is the total recovery of gasoline from crude and how has it increased during recent years? The answer is given for five years and also for the first six months and the month of June of this year.

TABLE 1

Five years of Motor Fuel History showing the relation of Straight-run, Cracked, and Natural Gasoline*

Year	Total Gasoline Barrels	Total Cracked-Gasoline Bbls. and pctge.	Total Natural Gasoline Bbls. and pctge.	Total Straight Run Gasoline Bbls. and pctge.
1925	259,601,000	68,583,000 26.4	19,636,000 7.6	171,382,000 66
1926	299,734,000	93,736,000 31.3	27,696,000 9.24	178,302,000 59.5
1927	330,435,000	101,226,000 30.7	32,162,000 9.7	197,047,000 59.6
1928	376,945,000	122,554,000 32.6	35,223,000 9.4	219,168,000 58.0
1929	434,241,000	143,759,000 33.2	45,463,000 10.4	245,019,000 56.5
First 6 mos. 1930	223,317,000	80,111,000 35.9	25,394,000 11.36	117,802,000 52.74
Month of June, 1930	37,079,000	13,675,000 37	3,879,000 10	19,525,000 53

TABLE 2

Crude Oil Charged to Still, Gasoline Produced, and Increase in Recovery Over a Period of Five Years*

Year	Barrels Crude to Stills	Gasoline yield from Crude Bbls.	Per Cent Gasoline Recovery
1925	739,920,000	239,965,000	32.43
1926	782,561,000	272,038,000	34.76
1927	828,835,000	298,273,000	36.0
1928	913,295,000	341,722,000	37.4
1929	987,708,000	388,778,000	39.36
First 6 mos. 1930	477,657,000	197,913,000	41.43
Month of June, 1930	80,747,000	33,200,000	41.11

*Source—Bureau of Mines Annual and Monthly Reports.

M-S-A *Combination* HOSE MASK

PERMISSIBLE
HOSE MASK
DEPARTMENT OF COMMERCE
BUREAU OF MINES
APPROVAL NO. 1901
ISSUED TO THE
MINE SAFETY APPLIANCES CO.
Pittsburgh, Pennsylvania, U. S. A.
Appliance is approved only when hose, harness, and blower bear approval No. BM-1901, also face piece assembly BM-1901 or 1901E. The length of the hose must not exceed 150 feet
In making renewals or repairs, parts identical with those furnished by the manufacturer under the original approval shall be maintained.
CAUTION
1. A life line shall be attached securely to the safety harness and held by two attendants when the mask is used for entering oil tanks, sewers and similar confined spaces, so that the wearer can be removed in case of accident or emergency.
2. Persons wearing hose masks should not enter places where the hose or life line may be entangled and fouled. Attendants must help in keeping these clear.
3. The hose mask will give respiratory protection in atmospheres containing hydrocyanic acid gas, but it is not safe to counter high concentrations because the gas is absorbed through the unprotected skin of the body and in that manner will produce poisoning.
4. The blower must be operated continuously during use of the mask.

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REFINERY AND GASOLINE PLANT ACTIVITIES

New Plants – Construction Notes – Personnel Changes

Enlargement and Modernization Work Active

REPORTS for the past month concerning expansion within the manufacturing branch of the petroleum industry have to do mostly with enlargement of present facilities at refineries and continued reports of mergers. Foreign refinery installations figure in the reports in about the same manner. New natural gasoline extraction plant installations are few. The lull in expansion and new building may possibly be attributed to the seasonal influences and it will not be surprising if the industry remains relatively inactive in its building for the next few months, erecting only equipment essential to modern scientific operation.

Reports of proposed $2,000,000 expansion programs at the Gulf Coast refineries of Sinclair and Magnolia, have been received. Lubrite (Vacuum) at St. Louis is installing two more units of Pratt vapor phase cracking process and a 3,000-barrel tubular redistillation unit to handle pressure distillate. Pure Oil has begun construction of its 6000-barrel refinery at Toledo and has announced that three Gyro vapor phase units will be installed. Gulf Refining Company is letting contracts for construction of various departments at its new Pittsburgh plant. Big Horn Oil & Refining Company has about completed its small plant at Billings, Montana.

Gwin Drilling Company has leased the skimming plant at Wewoka, Oklahoma, from Wewoka Refining Company, which built, but never operated it. Sunray at Allen, Oklahoma, is installing a 3000-barrel topping plant. Independent Producers Refining Company has been organized to erect a 2000-barrel skimming plant and Dubbs cracking unit at Logan, Ohio. In California, Superior Oil Company plans a refinery at Huntington Beach pending permission from the city fathers. El Camino Oil Company proposes a new plant near Los Angeles to refine Playa del Rey crude.

Distillazione Italiana Omustibili S. A. Venice, Italy, known to the industry as Disca, is erecting a Dubbs cracking unit. In France, Societe Anonyme d' Exploitations Minieres, operators of the Pechelbronn refinery, propose to erect a new refinery on a site not yet chosen. Franco-American Refining Company, composed of Standard of New Jersey and the Gulf and Atlantic Companies, at Rouen, will build a modern plant pending action of the French Parliament this fall. Societe des Raffineries de Petroles de la Giroad is erecting a refinery at Bordeaux. Raffineries de Petrole du Nord (Petrolfina and Union des mines) contemplate the erection of a new refinery at Dunkirk, France.

Superior Oil Company is rapidly completing a 100,000,000 cubic feet capacity natural gasoline extraction plant in the north dome territory of the Kettleman Hills, California field. Signal Oil Company has completed its new West Texas gasoline plant at Best (Big Lake field, Reagan County). Pacific American Gasoline Company, at its Borger, Texas, plant is erecting equipment to double capacity to approximately 80,000 gallons daily.

Big Horn Plant Nears Completion

Big Horn Oil & Refining Company, Billings, Montana, a new refinery which is rapidly nearing completion of cracking and lubricating oil departments, plans to be cracking this month. The manufacture of lubricants will begin in about 60 days. This will be the first Montana refinery to produce lubricants and greases. Crude from the Osage field, Eastern Wyoming, and the Pedro field, near the Osage, will be processed; the first oil for gasoline and the second for lubricants, respectively.

Enlarging Canadian Plant

Canadian Oil Companies Ltd., 12 Strachan Avenue, Toronto, is contemplating early enlargement of its refinery and storage plant at Petrolia. Estimated cost is $250,000.

Italian Cracking Unit

Distillazione Italiana Comustibili, S. A. Venice, Italy, at the refinery there is now erecting a Dubbs cracking unit. The Disca Company will import a fuel oil, mazout or pacura which will be charged directly to the cracking unit which is designed for either non-residuum or residuum operation. Universal Oil Products Company is supervising construction.

May Build Refinery

El Camino Oil Company is considering the erection of a refinery near Los Angeles to handle crude from the Playa del Rey field, but has not completed plans for the plant. The company is drilling in the field and the success of its own operations probably will affect its course in the matter.

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REFINERY AND GASOLINE PLANT ACTIVITIES

Shale Oil Plant

Estonia Coal Company (A. S. Eesti Kiwioli) Estonia, with which the government has entered into contract for shale fuel for the state railways, has started erection of a new shale oil works to treat approximately 500 tons of shale per day.

French Refinery Planned

Franco-American Refining Company, controlled by companies operating in the United States, proposes construction of a refinery and dockage at Rouen, France, pending action of the fall session of the French Parliament. Favorable action will result in immediate construction. A second plant is under consideration to be erected on the Tancarville Canal. The company's interests are Standard Oil Company, New Jersey, Gulf Oil Corporation, and Atlantic Refining Company, Estimated cost is $8,000,000.

Pittsburgh Refinery Building

Gulf Refining Company is well along on construction of its Neville Island plant at Pittsburgh. Contract has been let for machine shop and plants are in preparation for hot oil building, gas plant, pump house, compressor plant, and gas plant accumulator and pump house. Site is being prepared for modern distillation equipment.

Wewoka Plant Leased

Gwin Drilling Company, Oklahoma City, has leased the skimming plant of Wewoka Refining Company, Wewoka, Oklahoma and will operate to provide outlet for crude oil controlled in the Asher and St. Louis pools. The plant, with a capacity of 2000 barrels, was erected last year by Wewoka capital but never operated.

Ohio Refinery Planned

Independent Producers Refining Company has been incorporated by oil producers and marketers in Ohio, and will construct a 2000-barrel tube still type refinery at Logan, Ohio. Plans for the plant include a Dubbs cracking unit in addition to the skimming plant. Arthur G. McKee Company, Cleveland, will have charge of design and construction of the plant. M. S. Luper, Columbus, Ohio, is chairman; I. C. Grimm, Woodsfield, Ohio, is president; O. C. Dunn of Marietta, is vice-president and Barton Holl of Logan is secretary and treasurer.

Lubrite Rerun Unit

Lubrite Refining Company (Vacuum Oil Company) at East St. Louis, Illinois, is building a 3000-barrel re-run unit to handle pressure distillate produced by its Pratt vapor phase cracking units, two units of which are now under construction. (See Refiner and Natural Gasoline Manufacturer, September, 1930, page 144). In addition a vapor recovery plant circulating 220,000 gallons of oil is to be installed to extract 50 per cent butane from the combined gas from topping, cracking rerun and tanks. A 100,000-gallon stabilizer is to stabilize a feed composed of cracked and absorption gasoline. Southwestern Engineering Corporation is erecting the new equipment.

Coastal Refineries Expanding

Magnolia Petroleum Company at its Beaumont plant and Sinclair Refining Company at its Houston (Deer Park) plant are currently reported in the trade and scientific press and newspapers to be contemplating expansion programs at the plants mentioned. In each case the estimated expenditure is placed at $2,000,000. Neither confirmation nor denial has been forthcoming from local plant managements in this territory. It

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REFINERY AND GASOLINE PLANT ACTIVITIES

is reported, however, that expansion will include for the greater part replacement of obsolete distillation facilities and increased cracking equipment. Sinclair will erect two more cracking units, a 20,000,000 cubic feet gas recovery plant, six 80,000-barrel storage tanks and other equipment.

Transcontinental Now Marathon

Mid-Kansas Oil & Gas Company will operate its refining and marketing divisions under the name of Marathon Oil Company. Thus the three Transcontinental Oil Company refineries will change name. The new company will take over all of the subsidiary marketing companies formerly operated by Transcontinental. Marathon has been the trade name of Transcontinental products for several years.

Panhandle Plant Expanding

Pacific American Gasoline Company, subsidiary of Huber Petroleum Company, at its Borger, Texas absorption natural gasoline plant, is installing additional Southwestern equipment to increase capacity from 30,000 to 60,000 gallons daily. A 20,000-gallon stabilizer unit of the same manufacture is also under construction.

Pure Building at Toledo

Pure Oil Company has begun construction work on its new refinery at Toledo, Ohio, announced last month. The skimming plant will be of 6000 barrels daily capacity and the plant will be provided with three Gyro vapor phase cracking units. It is located on an 80-acre site purchased from Standard Oil Company of Ohio, on the Maumee Bay, adjoining the recently completed terminal installed by Chesapeake & Ohio Railroad. Pure will use Standard's marine terminal, however, for the time being, and will later install its own docks.

New Refinery for France

Raffinerie de Petrole du Nord (Petrolfina and Union des Mines) contemplates a new refinery at Dunkirk, France. The plant is to be erected on a site of 90 acres, to process 300,000 tons crude yearly, and with 100,000 tons tankage. Substructural work is in progress and excavation for docking light tankers begun. Plant should be in operation about the middle of next year.

Signal's Plant Completed

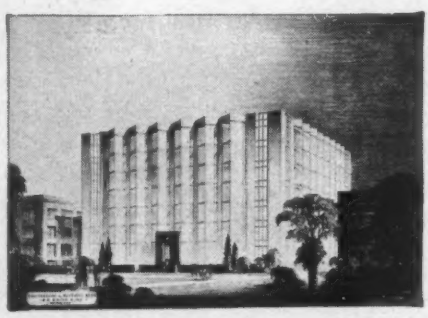
Signal Oil Company has completed construction of a 35,000,000-cubic foot absorption plant in the Best field in Texas, C. F. Braun & Company having been the contractors. The plant is expected to recover about 27,000 gallons of gasoline per day.

Refinery in France

Societe des Raffineries de Petroles de la Gironde is erecting a refinery at Bordeaux, France. The topping unit of 7500 barrels capacity, the 4000-barrel re-run unit, and the combination absorption vapor recovery and pressure distillate degasification unit, are Southwestern Engineering Corporation design and construction. In addition the plant will have two 2500-barrel cracking units, a complete chemical treating department and all auxiliaries necessary to a modern refining plant. General contractors are Societe des Installations Industrial.

Pechelbronn to Expand

Societe Anonyme d'Exploitations Minieres, operators of the Pechelbronn refinery, France, which is located in the north portion of the plain of Alsace, between Brumath and Wissembourg, has recently acquired a holding in the company known as Brest-Port Petrolier, and proposes the construction of a new refinery on a site not yet chosen. The Pechelbronn refinery is a complete plant, making all products of petroleum including lubricants by the Steinschneider vacuum process and wax separation by Sharples super-centrifuge method.



A. O. Smith Corporation, Milwaukee, has completed the first of its manufacturing units, an automatic frame plant, which is as nearly 100 per cent automatic as it is economical to make a factory.

This extreme will be matched on the other hand by the Engineering and Research Building—a seven story building now under construction—by a unit centered solely on the work of men.

The production in this new factory will be the result of the scientific human element where men's brains, and not their hands, will be the major operating factor.

Polish Plant Expansion

Spolka Akcyjna "Fanto" (Malapolska group), at Ustrzyki Dolne, Poland, near Lwow, and Spolka Akcyjna "Nafta" at Drohobycz, owned by the same group which is of French nationality, is installing two 60,000-gallon stabilizer plants at the two refineries, of Southwestern Engineering Corporation design.

Sunray Building Topping Unit

Sunray Oil Company is building a 3500-barrel topping unit at its Allen, Oklahoma plant (formerly Homaokla Oil Company) which consists of a tube still and an 82-inch main fractionator-evaporator column. Southwestern Engineering Corporation is erecting the plant.

Huntington Beach Refinery

Superior Oil Company, an independent producer in California has purchased 14 acres for a refinery site at Huntington Beach, California, on which it contemplates erection of a refinery pending permission by Huntington Beach city council.

Absorption Plant Building

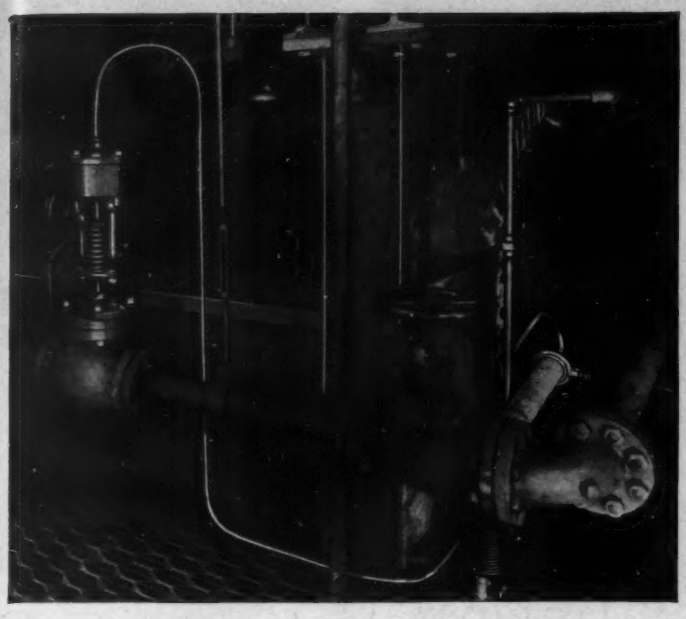
Superior Oil Company is working at top speed to complete a large absorption plant at Kettleman Hills to handle the 100,000,000 cubic foot flow of gas rfom its recent 11,000-barrel completion on the North Dome. This will be the sixth absorption in the field. The company's Huffman came in as the largest producer in the field to find no provisions for handling the huge flow of natural gas. C. F. Braun & Company is building the plant.

Texas Company Changes

The Texas Company has announced the transfer of W. K. Holmes from the company's refinery at Port Arthur, Texas, where he has been superintendent for the past several years, to Los Angeles, where he has been promoted to vice-president and general manager of The Texas Company of California.

T. G. Dellinger, formerly assistant superintendent at Port Arthur has been made superintendent. W. E. Repschlaeger has been promoted to first assistent superintendent and F. L. Wallace second assistant superintendent. Mike Helpern is manager of the refning department.

L. F. W. Wilking of Houston has been transferred to Casper, Wyoming where he is in charge of plant operations. He is succeeded in Houston by J. S. Worder, formerly at the Amarillo, Texas refinery.



Bailey Thermo-Hydraulic Feed Water Regulator installed on 534 h.p. boiler.

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Steam cost, both for generation and for distribution, may be greatly decreased by the improved boiler efficiency and more careful steam utilization which results when Bailey Meters and Feed Water Regulators guide and control power plant operation.

Maximum combustion efficiency consistent with economical boiler operation results when firemen are guided by the Steam Flow—Air Flow relation of the Bailey Boiler Meter. Losses are recorded the instant they occur, and at the same time the adjustments which must be made to restore efficiency are clearly indicated. Waste is turned into power, and profits increase.

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Long recognized as standard equipment in central stations and large manufacturing plants, Bailey Metering, Control and Regulating equipment is now serving the oil industry by reducing the cost of refinery operation.

Write for Bulletins 43, 82 and 162. They describe Bailey Boiler Meters, Thermo-Hydraulic Feed Water Regulators and Multi-Pointer Gages.

Bailey Boiler Meter and Multi-Pointer Gage installed on a 1022 h.p. boiler in a large eastern refinery.

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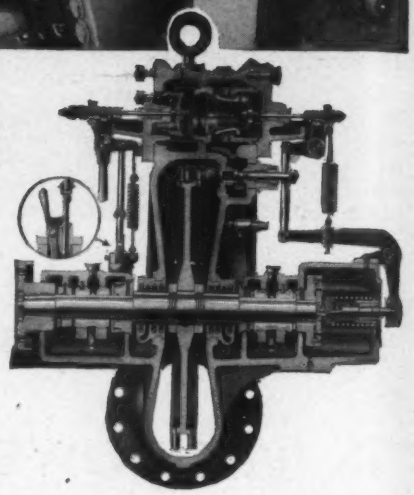
De Laval Turbines for Back Pressure



THE supplying of exhaust steam to processes under back pressure is the service for which the De Laval Velocity Stage Steam Turbine has been particularly designed. It is exceedingly simple, consisting essentially of a single wheel rotating with ample clearances in a casing containing steam at exhaust pressure and temperature only. High pressure steam is confined to the governor valves and steam chest, which are integral with the cast steel casing cover, above and well removed from the bearings. The casing is supported near the plane of the shaft eliminating misalignment from thermal expansion. Individual nozzle valves give high efficiency over a wide range of load and steam conditions.

The 50 horsepower turbines, each driving a cooling water pump and a gasoline pump, here shown, receive steam at 140 lbs. gage and exhaust against 30 lbs. back pressure. There are five such units in the plant.

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Steam Turbine Company
Trenton, New Jersey

Local Offices: Atlanta, Boston, Charlotte, Chicago, Cleveland, Duluth, Havana, Helena, Honolulu, Houston, Kansas City, Los Angeles, Montreal, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., St. Paul, Salt Lake City, San Francisco, Seattle, Spokane, Toronto, Vancouver,

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Manufacturers of Steam Turbines, Centrifugal Pumps, Centrifugal Blowers and Compressors, Flexible Couplings, Double Helical Speed Reducing Gears, Worm Gears, Hydraulic Turbines and Special Centrifugal Machinery.

New Equipment for the Modern Plant

Potentiometer Pyrometer

WILSON-MAEULEN COMPANY

Wilson-Maeulen Company, Inc., 383 Concord Avenue, New York City, is marketing a new potentiometer recording pyrometer, Model No. 8201. This instrument is added to the company's line of temperature measuring apparatus. It operates on the potentiometric principle and has a temperature record chart 12 inches wide, and shows a number of other new features of mechanical and electrical design.

In this potentiometer recorder, when the measured voltage from the thermocouple changes, as a result of temperature change at the thermocouple, the galvanometer pointer deflects in the corresponding direction.

At intervals of 10 seconds a boom descends and grips the pointer while two sensing fingers, moving in a vertical plane, approach the pointer from each side and if either finger finds the pointer deflected and away from its central or null position, a roller ratchet dog is released by the finger, causing a drum to turn.

By means of a violin string wound around the drum and passing over pulleys at each side of the chart, and attached at opposite sides of a carriage, the motion of the drum in either direction is transmitted to the carriage which is adapted to travel back and forth across the whole instrument.

The carriage carries the pen which marks the chart in its travel, and a contact brush that rides on the potentiometer slide wire.

The selective operation of the drum's rotation, both in direction and extent, moves the contact on the slide wire so as to bring the galvanometer back toward its null or undeflected position, and at the same time moves the recording pen to record on the chart the temperature of the thermocouple.

A choice of three chart speeds, namely three-fourths-inch per hour, 1½ inches per hour, and three inches per hour, permits the user to secure the chart speed most suitable for his needs.

Changes in the temperature of the thermocouple cold junction are automatically compensated for in the instrument by an electric cold junction compensator, similar to the automatic compensators used on all types of Wilson-Maeulen pyrometers for several years.

An external drive unit, consisting of an ample sized synchronous, ball bearing motor and double worm and gear speed reducing system, located outside the instrument case, furnishes power to the instrument mechanism.

This drive unit is similar to the drive unit employed on Wilson-Maeulen automatic temperature controllers for a number of years, and is supplied with this recorder for either 110 volts or 220 volts alternating current.

Charts are available in both Fahrenheit and Centigrade scales, to suit the various types of thermocouples and to suit various temperatures.

For low temperature operations, from 600°F. down to 0°F. or lower, this same recorder is supplied to operate as an electric thermometer employing resistance bulbs.

The instrument case opens diagonally, making the entire mechanism easily accessible.

Catalog P-5-1, describing and illustrating recorder, has been issued and is available on request.

Potentiometer Pyrometer

Insulating Materials

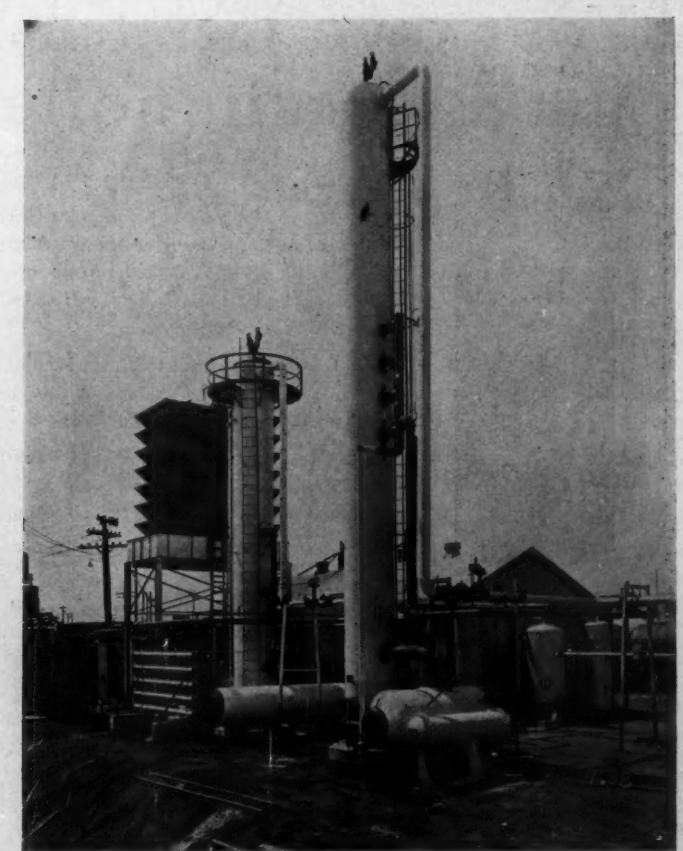
EAGLE PICHER LEAD COMPANY

Eagle Picher Lead Company has introduced into the petroleum industry a line of insulating materials, made from minerals, which are recovered in the mining of lead and zinc. Insulating blanket, insulating cement and pipe covering are now being offered. Literature of the company reads as follows, concerning the products:

"The insulating material in all of these products is a highly refined mineral wool, which is blown at high temperature from a fusion of flint rock and other silica bearing materials. The wool is light, clean and is free from sharp needle-like particles and has a therman conductivity of .286, as determined by the Bureau of Standards.

The illustration pictured herewith shows the vapor recovery system of the Kanotex Refining Company, Arkansas City, Kansas. The equipment was covered first by 1½ inches of mineral wool blanket, banded by half-inch metal bands, with a half-inch layer of Eagle 66 insulation cement. Eight ounce duck was then added and covered with water proof paint.

Headquarters of Eagle-Picher Lead Company are in Chicago, while the insulation products are being manufactured at Joplin, Missouri.



Kanotex Refining Company, Arkansas City, Kansas

NEW EQUIPMENT FOR THE MODERN PLANT

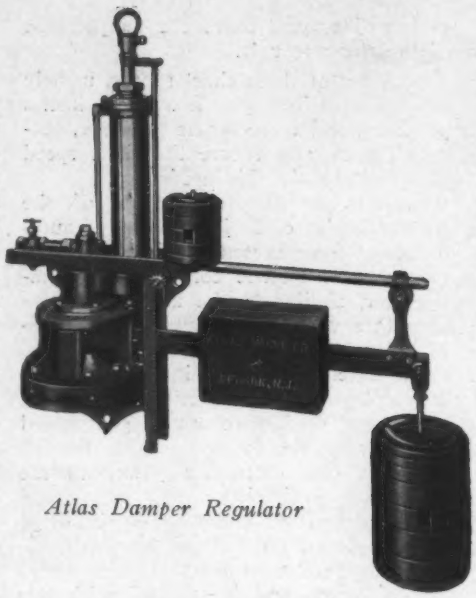
Improved Damper Regulator

ATLAS VALVE COMPANY

Atlas Valve Company, 282 South Street, Newark, New Jersey, announces an improvement in damper regulators. The new design, shown here, offers sensitive control of the damper at all times.

Constant pressure admitted to the top of the cylinder forces it downward when the pilot valve is closed and the discharge port in its stem is open. When the stem closes the discharge port and opens the valve the water flows to the bottom of the cylinder, as the effective area on top of the piston is reduced by an amount equal to the area of the piston stem, and the water pressure below forces it upward.

When the boiler pressure is between the minimum and maximum desired pressure the lever is balanced by the pressure under the diaphragm at a point where the discharge port in the stem of the pilot valve is closed by the valve stem and the valve is held closed by a spring. When no water is entering or leaving the cylinder, the piston stem is held stationary. If the boiler pressure increases, the diaphragm will raise the lever and



Atlas Damper Regulator

open the pilot valve, permitting water to flow into the bottom of the cylinder and force the piston upward. As the piston rises, the rack is pulled upward and rotates a pinion, which causes the rack and weights to move outward, thereby increasing the weight on the lever by degrees until this increase causes the lever to descend and close the pilot valve to arrest any further piston travel.

When the boiler pressure decreases the lever will lower and the valve stem falls. The water will then flow from the bottom of the cylinder through the pilot valve discharge port and permit the pressure on top of the piston to force it downward by which operation the weight bearing upon the lever is gradually diminished. This enables the lever to rise again, close the pilot valve discharge port and hold the piston stationary in the position into which it has been moved.

Automatic Radio Control

BAILEY METER COMPANY

Bailey Meter Company, 1057 Ivanhoe Road, Cleveland, will have an exhibit in space No. 227 at the American Gas Association Convention at Atlantic City, New Jersey, October 13-17, showing the Bailey automatic radio control as applied to the mixing of gases and to the mixing of gaseous fuel with air to secure the highest combustion efficiency consistent with the economical operation of open hearth and other types of industrial furnaces.

A displayer on which will be mounted a number of photographs of Bailey meters as installed in various industrial

Your own maintenance crew can install and maintain boiler and still settings with PX-33!

PX-33 is a moldable furnace lining in stiff, mud-like form. It is firebrick in an unfired state, made from first quality Colorado flint fire clay.

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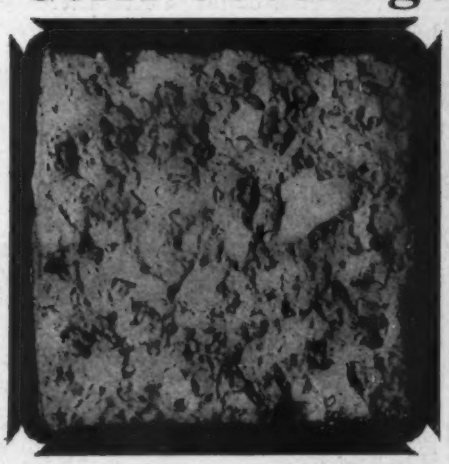
PX-33 forms a monolithic furnace lining, eliminating all open and leaky joints, and offers unequalled resistance to melting, spalling, slagging and fluxing.

These advantages make PX-33 ideal, not only for entire furnace walls, but for repairing and patching fire brick walls and replacing special shapes. Write for Bulletin 143.



Cross-section of PX-33 mass, showing its angular, *internal skeleton*, formed by the interlocking lugs of calcined flint clay.

THE DENVER FIRE CLAY COMPANY

DENVER DFC COLO. U.S.A.

BRANCHES AT SALT LAKE CITY, EL PASO, AND NEW YORK

DFC DISTRIBUTORS:

El Paso, Texas ..... Neff-Stiles Company
Los Angeles ..... H. F. Bakemeyer
New Orleans ..... J. J. Clark Co., Inc.
Ogden, Utah ..... Ogden Press Brick & Tile Co.
Phoenix, Arizona ..... V. L. Clark Building Material Co.
Portland, Oregon ..... Kline Specialty Co.
Provo, Utah ..... Provo Brick & Tile Co.
Reno, Nevada ..... Flanigan Warehouse Company
San Francisco ..... W. E. Mushet Co.
Santa Fe, New Mexico ..... Santa Fe Builders Supply Co.
Wichita Falls, Texas ..... Greene Brothers

UNIFORMITY IN ALL RESPECTS

In size — in texture — in quality — in all respects, General Refractories brick have *always* been noted for their uniformity.

Uniform brick, as originally introduced by General Refractories, make possible thin, regular joints and help materially to increase furnace lining life. Ask for recommendations to meet your individual needs.

GENERAL REFRACTORIES COMPANY

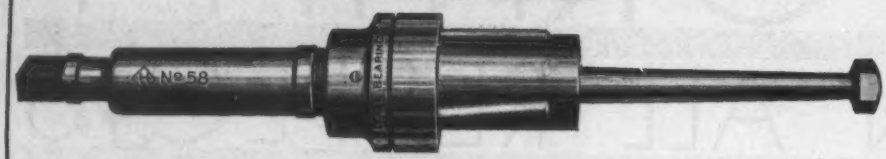
106 South 16th Street, Philadelphia, Pa.

District Offices: Birmingham, Boston, Buffalo, Chicago, Cleveland, Detroit, Indianapolis, New York, Pittsburgh, St. Louis, San Francisco

Representatives: Seattle, Montreal, Havana, Cuba

4793A

Heavy Duty Expanders for Still Tubes



Tools for the Oil Industries

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches

A. L. HENDERER'S SONS
Wilmington, Del.
Established 1870
Expanders since 1884

Relief for your Tanks

Protection for your Meters

CF

Vacuum Relief Valve Regulators

In case of line stoppage or other causes that result in the pulling of a Vacuum in storage tanks and purifiers, this Regulator comes quickly to the rescue. It is placed in a line between suction and discharge of compressor so that, should the pressure in the suction line to the compressor drop to zero, the Relief Valve will open and relieve the vacuum tendency. For a vacuum of 8 oz. or less, use the Duplex Regulator shown above. For higher vacuums use the single diaphragm Vacuum Relief. Action is reliable. Thousands of meters and tanks have the constant protection which this C-F offers you.

Data upon request.

The Chaplin-Fulton Mfg. Company

Organized 1884—Oldest Builders of Gas Regulators in the Country. Built in all Sizes, From 1 Inch to 24 Inches; For all Service. 1 oz. up to 2,000 lbs. Pressure to Square Inch

28-40 Penn Avenue *Representatives:* Pittsburgh, Pa.

Westcott & Greis, Inc. Jno. W. Crawford

Sales Service: Dallas—Los Angeles—Tulsa *Sales Engineers:* 1855 Industrial St., Los Angeles
Or Any Jobber

plants to meter gas, steam and water will be a feature of the exhibit.

The special feature, however, will consist of a ratio control which automatically proportions the gases or liquids in the desired ratios. This control will be set up to mix two gases in any desired proportion. It will show how coke oven gas may be automatically mixed with blast furnace gas in order to provide a low cost satisfactory fuel for use in open hearth furnaces, annealing furnaces and other mill uses. The set-up will also show how gaseous fuel and air may be automatically proportioned to secure the best combustion efficiency in the burning of gas.

Bailey ratio control is a new development which automatically operates valve dampers, etc., by means of hydraulic pressure operating a power cylinder. Pressures in the power cylinder depend upon the position of a pilot valve which, in turn, is operated directly by flow meters measuring the gases or liquids being mixed. A special stabilizer connected to the pilot valve insures a quick acting control which has no tendency to hunt.

The boiler control panel gives the necessary information for securing the maximum combustion efficiency which is consistent with economical operation of a steam generating unit. Steam flow, air flow and flue gas temperature are recorded by the Bailey boiler meter, while inlet and outlet gas temperatures and inlet and outlet water temperatures to an economizer are recorded by the temperature recorder. The factors of secondary importance in boiler operation are indicated by the Bailey multi-pointer draft gage which is also located on the boiler control panel.

The unique features of the Bailey feed water regulators are a fully balanced tight seating regulating valve which incorporates a removable valve cage. The ports of this regulating valve are so designed that the valve has a straight line flow characteristic.

Lubricated Valves

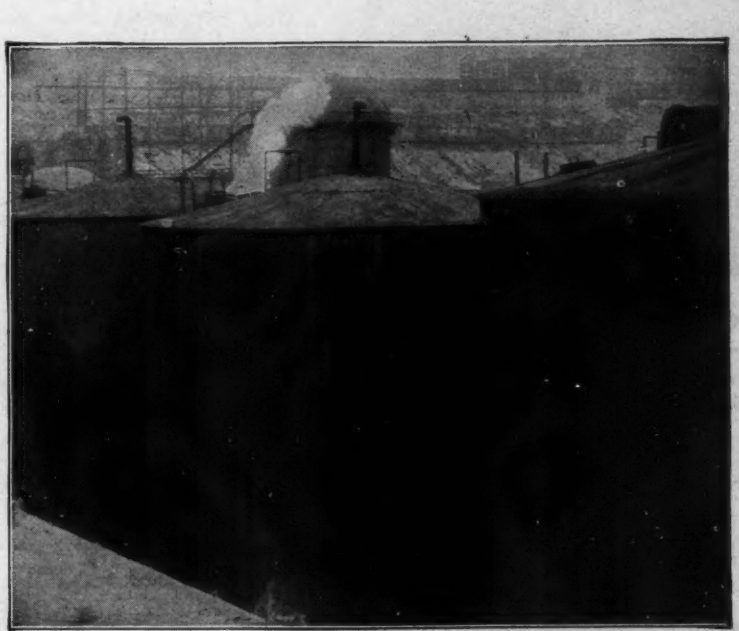
MERCO NORDSTROM VALVE CO.

Merco Nordstrom Valve Company is on production with the manufacture of Venturi series lubricated valves that are subjected to hydraulic tests ranging to 6000 pounds. These high pressure valves are made of cast steel and embody the "Sealdport" principle of lubrication. Venturi valves range in pressure tests from 150 pounds up. The 150-pound valves are subjected to a primary air test of 75 pounds, a secondary air test of 150 pounds and a hydraulic test of 300 pounds. All of the valves manufactured under the Nordstrom name are subjected to tests twice their rated capacity. The hydraulic test is intended to prove valve resistance to rupture primarily and is made on valves with both ends blanked off and the plug in cracked position. Where the hydraulic test required exceeds 500 pounds the valve is tested with water pressure on both sides of the plug and in closed position. The hydrostatic

ARMCO INGOT IRON

makes metal equipment dollars *buy more years of service*

WITH thousands of dollars invested in such metal equipment as weak acid towers, storage tanks, agitators, tank tops, pipe and tubing, and roofing and siding, much depends on the metal selected. Will it succumb all too quickly to the incessant attacks of corrosion?—or will it, like Armco INGOT IRON, return a substantial profit measured in long, low-cost service?



When you choose rust-resisting Armco INGOT IRON for your plate and sheet equipment, the evidence of the years backs your judgment. More than two decades of severe and diversified service attest its enduring qualities—the longest record of actual service of any low-cost, rust-resisting plates and sheets.

Since 1912, Armco INGOT IRON Tank roofing has shielded valuable oil supplies in a battery of tanks belonging to a large Ohio refining company. The surrounding corrosive conditions are severe and the plant engineer is very well pleased with this service.

Whether your metal problem be one of fabrication or corrosion, an experienced Armco Engineer can help you shed light on it. He is available at any of the offices listed below. All you need to do is write and appoint the time for discussion.

THE AMERICAN ROLLING MILL COMPANY

Executive Offices: Middletown, Ohio

Export The ARMCO International Corporation

DISTRICT OFFICES:	Chicago	Detroit	Pittsburgh
	Cincinnati	New York	St. Louis
	Cleveland	Philadelphia	San Francisco

ARMCO

Back of this familiar symbol is thirty years' experience in the manufacture of special analysis iron and steel sheets and plates. When you want a rust-resisting, low-cost metal be sure to see this triangle and the words, "Armco INGOT IRON." It is your assurance of dependable economical service.

"Be Sure It's Made of Armco INGOT IRON"

An airplane view of part of a refining plant at Ponca City, Oklahoma, showing our cooling tower. This tower is 60 feet high.

Cooling Water From 150 Degrees to 74 Degrees

THE 70 degree wet bulb is the July average for Oklahoma. Our problem was to design a cooling tower which would cool water going on the tower at temperatures from 125 degrees to 150 degrees to a point within 5 degrees of the wet-bulb, cooling over a range as much as 75 degrees.

The solution to the problem was a cooling tower 60 feet high with twenty decks. That cooling tower was installed almost four years ago, and the results to date have been entirely satisfactory. Records have been kept of the daily and often hourly performance of this tower, and true wet-bulbs have been taken with a sling psychrometer as well as stationary wet-bulb readings, so that the performance of the tower has been checked in every way against the cooling results it was designed to accomplish.

Not every refining plant has a water cooling problem like this. We cite this merely to show that our engineering department can handle difficult assignments when necessary. Ordinarily our Standard Type Cooling Towers will meet your requirements perfectly. They are described in our Bulletin 283-R, a copy of which will be sent on request.

THE COOLING TOWER COMPANY, INC.
15 JOHN STREET, NEW YORK
Representatives in Principal Cities

TULSA
Whealton & Townsend, Inc.,
120 E. Brady St.

HOUSTON
J. A. Rossiter Company
410 Union Nat. Bank Bldg.

W. N. BEST High Pressure Oil Burner

W. N. BEST Oil Burners

are

dependable, efficient, economical, non-clogging atomizers of fuel oils, tars, acid sludges and still bottoms.

Write for catalogs.

W. N. BEST CORPORATION
Engineers and Manufacturers Since 1890
295 Fifth Avenue, New York City

pressures, according to Nordstrom engineers are doubled the rated cold working pressures in practically all of these lubricated valves.

Industrial Wire Cloth

NEWARK WIRE CLOTH COMPANY

Newark Wire Cloth Company, 351-365 Verona Avenue, Newark, New Jersey, manufacturers of wire cloth for all industrial purposes, announce that they are now manufacturing wire cloth of stainless steel. This cloth is made in all meshes, widths and lengths, and will be made as fine as 200 by 200 (40,000 openings per square inch) provided quantity orders will warrant.

Metal Cutting Torch

TORCHWELD EQUIPMENT COMPANY

Torchweld Equipment Company of Chicago announces a metal cutting torch which uses gasoline. This gasoline cutting torch unit consists of a cutting torch with four gasoline cutting tips; 25 feet of high pressure oxygen hose; 25 feet of flexible metallic gasoline hose; two-gallon welded gasoline tank; a high pressure two gauge oxygen cutting cylinder regulater; wrenches, goggles and gloves.

The manufacturer submits as major advantages of this new metal cutting torch the following: greater economy because of lower fuel gas cost; simplicity of design; greater safety because of the elimination of "flash backs" and torch flashing; and a reduction in the amount of equipment and supplies necessary for operation.

Detailed information on this new equipment will be furnished upon request to Torchweld Equipment Company, Chicago, Department O-8.

Registers

THE COEN COMPANY

The Coen Company, 428 Story Building, Los Angeles, will furnish detailed information upon request on a new type of register for use with gas or oil burners in refinery work recently designed by the company. This register is described as providing complete frontal insulation as well as greater capacity, with less air pressure. Used in connection with the Coen burner the register is designed to give a rotary motion to the air used for combustion without the use of air-directing vanes.

A new type cutter torch has been installed which offers to permit observation of the flame without heat or flare back. The register is designed for use with either a gas ring or with a straight oil fire, depending on individual preference.

The Coen Company has issued a bulletin covering in detail this new type register and its application to various burners, and will forward a copy upon request to the home office.

YOU CAN GET . . . AND *MAINTAIN* LOWER TEMPERATURES ECONOMICALLY WITH YORK

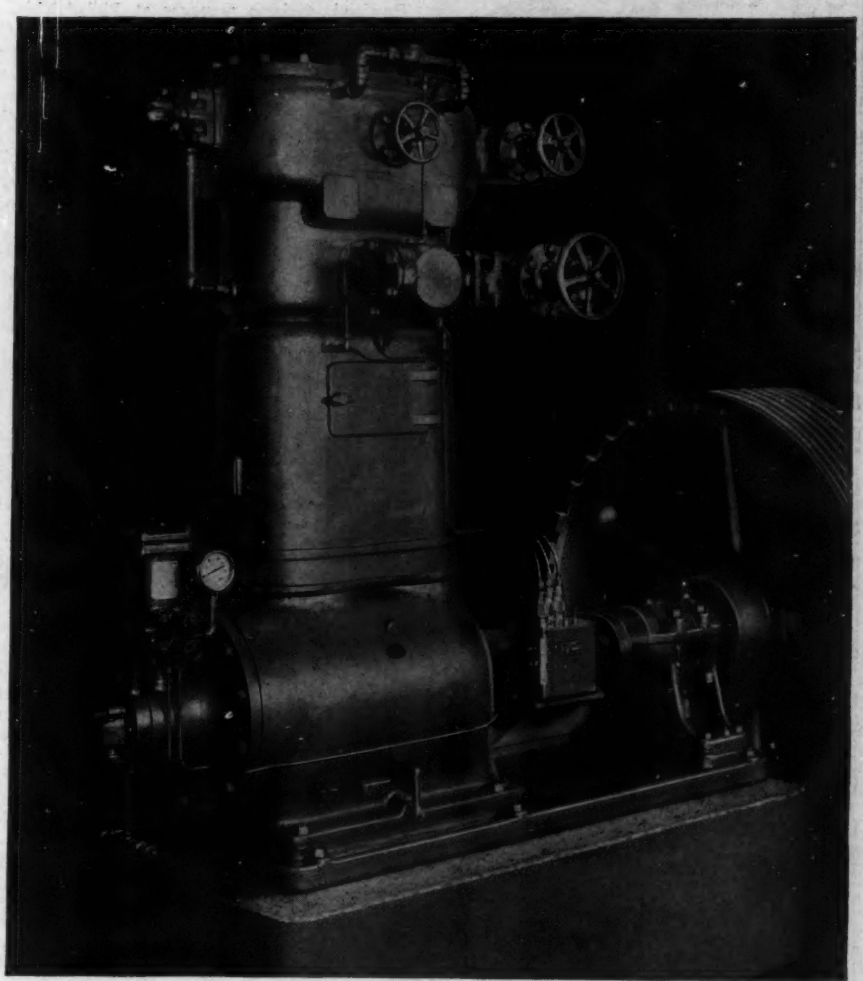
PATENTED AMMONIA LIQUID CIRCULATING SYSTEM

TEMPERATURES **below -60° F. are produced day in and day out in refinery processes with the York Patented Ammonia Liquid Circulating System.**

Important operating economies are also a feature of the York system. A substantial saving in power consumption results from higher operating suction pressures combined with the unique feature of keeping the entire evaporating surface continuously wetted by ammonia. This allows every square foot of surface in the evaporating system to do the maximum amount of useful cooling work.

Further economies are provided by the absence of static pressure on the liquid ammonia within the evaporator. A constant temperature and pressure exists throughout the evaporating coil surface. The York system is the only one having this very desirable characteristic.

Visit the York Exhibit at Tulsa Exposition and satisfy yourself of the real savings in operating costs that York engineers can show you.



York Booster or Stage Compressors are especially designed for oil refinery service and can be used in conjunction with your present refrigerating system.

YORK REFRIGERATION

YORK ICE MACHINERY CORPORATION . . . GENERAL OFFICE, YORK, PENNSYLVANIA

Information on these CAMPBELL Steam Flow Controllers for Oil Stills is obtainable by addressing The Campbell Engineering Co., 282 South St., Newark, N. J.

Whatever your steam control problems may be, place them in the hands of our engineers for solution. Scientific steam flow control for oil refineries is our specialty. We are also manufacturers of the TAR BABY BURNER, to handle Fuel Oils, Water Gas Tar, Acid Sludge and Residue Fuels.

The "Watermelon Type" controls steam through two delivery points simultaneously

The "Pumpkinseed Type" controls one delivery point.

Talking Points are Talking Points

But—

When hundreds of firms, on *Job* after *Job*, YEAR after YEAR—continue to use ANY one product—

It Must Have Advantages of Importance to You, Too.

Arrowhead Flooring, Grating and Treads

ARROWHEAD IRON WORKS, Inc.

431 WEST FIFTH

KANSAS CITY, MISSOURI

ITEMS ABOUT MANUFACTURERS

Bacharach Industrial Instrument Company, 7000 Bennett Street, Pittsburgh, has issued Bulletin 262, covering Bacharach engine indicators, Maihak type. The bulletin covers recent developments in the company's line of Maihak engine indicators, and will be forwarded to interested persons upon request.

Bailey Meter Company, Cleveland, Ohio, manufacturers of power plant metering equipment, automatic combustion control and feed water regulators, announces the opening of a branch office in Denver, Colorado. M. E. Reddick has been appointed manager of this branch office, which is located at 2370 Dahlia Avenue.

A. M. Byers Company has transferred H. R. Rowland, division manager at Philadelphia, to Pittsburgh as division manager. E. L. MacWhorter, representing the company in Western New York, has been made division manager with headquarters in Philadelphia. Announcement is also made of a national sales meeting to be held in Pittsburgh early in October. This meeting will be held in conjunction with the official opening of the company's new $12,000,000 plant for manufacturing wrought iron under the Aston patents.

A. M. Byers Company has appointed M. J. Czarniecki as manager of tubular sales, according to a recent announcement from H. W. Rinearson, vice-president. Czarniecki joined the Pittsburgh sales organization of A. M. Byers Company in 1913 and the following year was assigned to the New York office. In 1915 he was transferred to Chicago. He was moved back to the New York district three years later and in 1925 was appointed assistant sales manager of sales with offices in Pittsburgh.

Frank Parker has resigned his position as vice-president of Briggs & Turivas, Inc., Blue Island, Illinois, effective September 1, and has organized Iron & Steel Products, Inc., with offices in Railway Exchange building, Chicago.

Parker's service in the iron and steel industry dates back 25 years when he joined Republic Iron & Steel Company, now Republic Steel Corporation. Following 12 years with that organization he went with Briggs & Turivas. He is a chemical and metallurgical engineer, and is now president of the Chicago chapter of the Institute of Scrap Iron & Steel, Inc., general offices in New York City.

Cooper-Bessemer Corporation, Mt. Vernon, Ohio, announces that a 24-page bulletin, "New Type-10 Compressor Unit," is just off the press and ready for mailing. The bulletin covers completely the improved 100 B. H. P. single and 200 B. H. P. twin unit. A new compressor cylinder, a gas economizer and other field-proved features are shown and described, together with representative installations of this two-cycle gas engine compressor. Intended for engine buyers and for anyone who wishes to keep posted on power machinery developments, the bulletin is available upon request to Mt. Vernon, Ohio, or any of the Cooper-Bessemer offices.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

The Elliott Company, Jeannette, Pennsylvania, has issued new literature describing new equipment manufactured by this company. Bulletin J-2 covers the Elliott compensated machine giving engineering and construction data on the machine. The principle of compensation is explained by means of diagrams and oscillograms, and the construction features are fully illustrated and described. Bulletin J-3 covers the Elliott engine-type alternating current generators in eight pages, discussing voltage regulation and Diesel and gas engine applications. Bulletin L-5 is devoted to synchronous motors. Bulletin Z-8 takes up the Liberty tube cleaners of Liberty Manufacturing Company, an associated company of The Elliott Company.

Any of these bulletins will be sent on request mailed to the general offices at Jeannette, Pennsylvania, or to any Elliott distributor.

Foster Wheeler Corporation, 165 Broadway, New York City, announces that the expansion in its business of supplying equipment for power stations, oil refineries, and natural gasoline absorption plants has necessitated the opening of another branch office located at 712 Thompson building, Tulsa, Oklahoma, and is in charge of C. C. Steward.

Foxboro Company recently appointed C. C. Fuller manager of the company's New York office, replacing the late W. W. Patrick. Mr. Fuller will have charge of this office, and will be assisted by K. L. Barton, R. A. Rockwell and F. J. Leerburger.

General Electric Company, Schenectady, New York, has issued a 20-page booklet devoted to outlining copper brazing and copper-brazing furnaces. The subject is covered in an interesting style and is profusely illustrated to bring out a clear picture of this work.

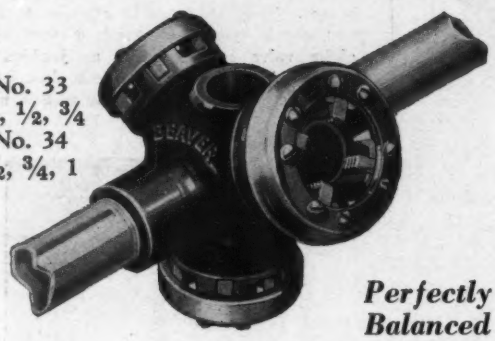
"Centrifugal Compressors" is the title of another booklet recently issued by General Electric Company, a publication approximately 75 per cent pictorial. The detailed features of General Electric blowers, illustrated throughout, is presented in this bulletin.

This literature will be sent upon request to General Electric Company's headquarters.

Hughes Tool Company, Houston, has issued a four-page folder devoted to covering briefly the Hughes valves and fittings for refinery service. A cut-away drawing of this refinery valve is carried with descriptive outline showing each part. Hughes Tool Company is in a position to furnish valves, fittings and special castings for high pressure, high temperature service of either chrome nickel or carbon steel as required. A copy of this descriptive folder is available upon request to the company at Houston, direct or through its Los Angeles, Oklahoma City, New York City or Midland, Texas, plants.

Byron Jackson Company, Los Angeles, will forward upon request a copy of the recently published folder describing and picturing the company's Deepwell turbine pumps. A complete outline of this pump is given in this folder, and pump sizes and capacities are listed in tabular form.

The New BEAVER 3-Way Die Stocks!



No. 33
3/8, 1/2, 3/4
No. 34
1/2, 3/4, 1

Perfectly Balanced

The New Beaver 3-Way Die Stocks are "companion tools" to the popular No. 3 Beaver Jr. Ratchet, the dies and caps being interchangeable.

Some outstanding features of the Beaver 3-Way tools are:

The *electrically heat-treated* die segments are *square* in shape and not weakened by any "shoulder" or off-set. No "tip" to break off!

The dies are *"driven" by the solid body of the tool*—not by a cap held on the body by screws.

Large openings in body provide *easy oiling* and *chip clearance.*

The die retaining ring is made of *pressed steel*—insuring strength. A "pinch" of 1/32" holds dies rigidly in position.

Extra-heavy and *extra-long handle bosses* are provided—so handles will not work loose.

The Beaver 3-Way tools are *light in weight*—and *fully self-contained.* No loose parts.

Dies and die retaining rings *interchangeable* with the *No. 3 Beaver*—an advantage to the thousands of shops now equipped with the No. 3 Beaver Ratchet.

Full width dies—equally serviceable for threading *steel, wrought-iron* or *brass* pipe.

Dies can be inverted for threading short nipples—when emergency requires.

Beaver 3-Way tools will give years of *trouble-free* service.

And, they are *moderately priced.*

"Buy it from Your Jobber"

THE BORDEN CO., 520 Dana Ave., Warren, O.

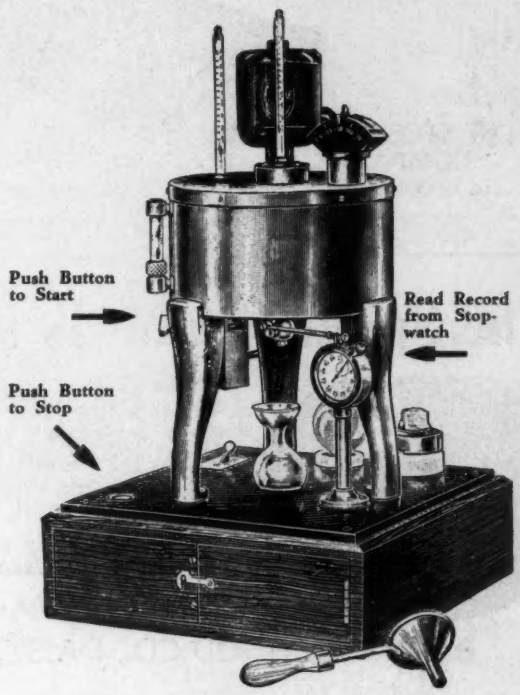
Die Stocks
Groovers

BEAVER

Pipe Cutters
Power Units

TESCHNER

"One Motion"
Control Viscosimeter



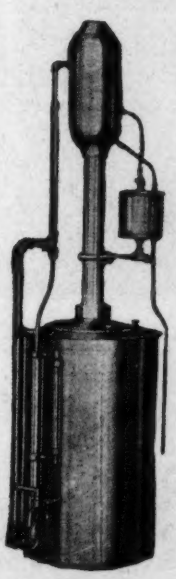
EVERY DETERMINATION ACCURATE

Write for Descriptive Leaflet to

Teschner-Meyers Co., Inc.
LABORATORY SUPPLIES
41-43 Warren St. New York, N. Y.

"New Standard"

Water Stills



Write for Analysis

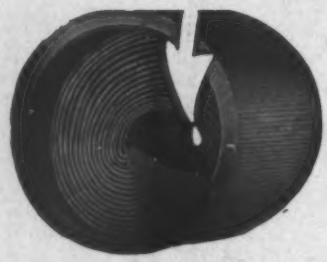
By Dr. Arthur Booth

KERLOW GRATING

FLOORS, STAIRS *and* LADDERS

KERLOW STEEL FLOORING COMPANY
220-22 CULVER AVE., JERSEY CITY, NEW JERSEY

The Spiral Motion Is the Trick



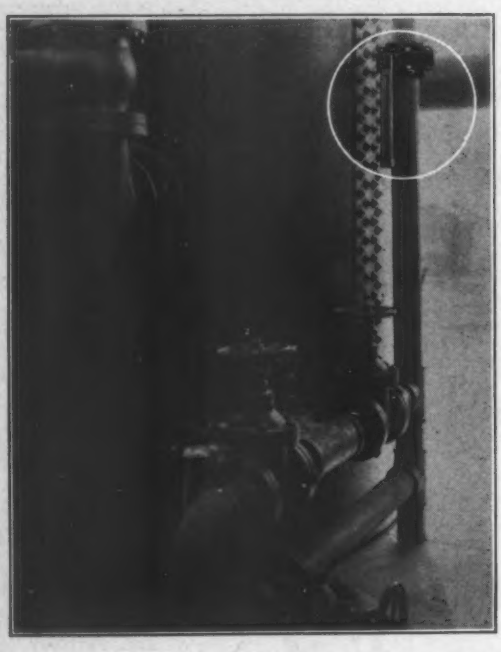
That's why Hood's Chemico Spiral Packing Rings have been selected by so many engineers. The center hole prevents choking and clogging.

Made of acid-resisting shale—practically indestructible.

Used by all big producers because of the intensive movements.

Samples on request

B. MIFFLIN HOOD CO., DAISY, TENN.



This cut shows an MJL Flow Indicator giving valuable information on Oil Flow to a Campbell Absorption Tower

MJL
FLOW INDICATORS

are extensively used by Refiners and Natural Gasoline Manufacturers for checking and balancing oil and gas flows.

The Direct Reading Scales calibrated to suit the individual requirements, in barrels per hour, cu. ft. per minute, etc.; coupled with the *Compact Design* and *Proven Reliability* makes these Indicators indispensable for efficient plant operation . . . And the cost is reasonable.

The Booklet Tells How MJL **Send for *Your* Copy**

MOREY & JONES, LTD.
MANUFACTURING ENGINEERS
922 So. Hemlock St., Los Angeles, Calif.

Items About Manufacturers

Jenkins Brothers, 80 White Street, New York City, has recently brought out a new line of standard bronze valves which are fully described in Bulletin No. 141. These valves have the one-piece screw-over bonnet and slip-on disc holder. They are made in a globe, angle, cross and check types for standard services. The globe valve is designated as Jenkins Figure 106-A. A copy of the bulletin describing this new line of valve will be furnished upon request.

E. A. WHITNEY

Joining the Mexico Refractories Company as manager of the specialties department with headquarters at Mexico, Missouri, E. A. Whitney has resigned his connection with A. P. Green Fire Brick Company, also of that city.

Mr. Whitney has been associated with the A. P. Green Company for a number of years, formerly having been in charge of the Tulsa territory and later having supervision over the specialty sales department of the company at Mexico. He is well acquainted in the refining industry. The Mexico Refractories Company are manufacturers of fire brick and other refractory products for general industrial uses.

National Foam System, Inc., Philadelphia, has issued a 32-page catalog covering the company's foam fire protection equipment, including chemical ejectors and equipment for continuous foam production, portable or stationary installations, manual or semi-automatic control, and special and sundry fire protection equipment. This catalog is profusely illustrated, showing methods of fire protection and extinguishing as well as showing the various lines of equipment and fire protection products.

Soars & Lovelace, Inc., with offices at 291 Plaza Theatre building, Kansas City, was organized in July of this year, for the transacting of oil refining engineering, particularly as consulting and designing engineers.

The principal members of the company, C. A. Soars and C. W. Lovelace are well known to oil refiners, particularly in the Mid-Continent field. Mr. Soars was formerly with Refinery Engineers of Kansas City, M. W. Kellogg Company and, previous to that time, for many years in the refining department of Standard Oil Company of New Jersey.

Mr. Lovelace was vice-president of Smith Engineering Company and was an executive with Cross Engineering Company and Cross-Widdell Engineering Company, companies specializing in oil refinery engineering and design. Previous to that Mr. Lovelace spent several years as an engineer with an English oil company with offices in London, and with Sinclair Refining Company.

CHARLITE HEAVY DUTY No. 1
for Stripping Paint

Trucks, Tanks, Drums, Tank Cars, Quickly Cleaned For Re-painting

Economical Efficient

Full Details on request

Charlite Division

CHARLOTTE CHEMICAL LABORATORIES

CHARLOTTE, N. C. 50 EAST 42nd ST., NEW YORK

Three Chamber Style for CO_2, O_2, CO.

Hays Gas Analyzers are standard for determining air content of casing head gas and for checking combustion efficiency of boiler furnaces.

1930 MODEL
HAYS IMPROVED GAS ANALYZERS

1—Light weight! Compact!

2—Fast! CO_2 reading in 30 seconds by steel wool surface method of gas absorption. Complete analysis for CO_2, O_2 and CO in four minutes!

3—Toncan iron spot welded case, highly corrosion-resistant.

4—Monel Metal needle valve! Renewable nickel needle valve seats!

5—Cleaned in two minutes. All parts readily accessible.

6—Glass parts arranged to prevent breakage. Heavy one-piece moulded glass absorption pipettes attached to moulded hard rubber chemical bottles with soft rubber gaskets and finger compression nuts. All parts easily renewed in the field.

7—Can be carried in any position without spilling or mixing the solution.

8—Convenient reels for rubber hose prevent kinking. More than 30,000 HAYS FLUE GAS ANALYZERS now in use all over the world. Present improvements, the result of operating experience, are the most important to be effected during twenty-five years of steady betterment.

R. S. MANOMETERS

The R. S. MANOMETER is made of a one-piece Pyrex glass U-tube. Manometer stands pressure up to 250 pounds per square inch and can be used to determine very accurately any pressure, vacuum, or differential pressure within the range. The scale for the Manometer is made adjustable—scale protrudes slightly over the glass tubes making accurate reading easy to take. Manometer may be obtained with scales of various ranges.

Send for our Bulletin—"15-R"—which describes these instruments in detail

BRANCH:
3404 Main St.
Dallas, Texas

The Refinery Supply Company
621 E. 4th St., Tulsa, Oklahoma

Pacific Coast Rep.
The Braun Corp.
363 New High St.
Los Angeles, Calif.

CHEMICALS FOR REFINERS AND NATURAL GASOLINE MANUFACTURERS

Use "Sparkl" To Clean All Metal Concrete and Woodwork

SPARKL "digs in." It is THE improved cleaner developed by expert chemists for use in the oil industry. It is made in several types, each one specifically prepared for a definite cleaning purpose.

SPARKL "A" positively cleans and brightens all METAL surfaces from polished plates to tank cars, bridges, buildings, etc.

SPARKL "B" is ideal for cleaning service station drives, all CONCRETE, BRICK, and SIMILAR SURFACES in refineries, natural gasoline plants, pipe line stations, etc.

SPARKL "C" was developed especially for cleaning natural finish WOODWORK, floors, walls, baseboards, etc.

SPARKL "D" is the mechanic's friend. It is a quick, thorough hand cleaner. It removes dirt and grease as if by magic. Yet it leaves the skin smooth and pliant.

Save time, money and muscle. Eliminate old-fashioned scrubbing methods.

CLEAN WITH "SPARKL"—the quick, economical, safe, healthy way.

Order a supply now and it will be forwarded to you immediately.

WARD CHEMICAL CORP.

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Oklahoma City, Okla. Wichita Falls, Texas

...If It's for SAFETY —We Have It!

No matter how exacting your safety requirements, PULMOSAN can serve you. Our Safety Engineers will be glad to make recommendations for your plant, without charge. Write us your safety problems, or mail coupon for information on equipment especially designed for refineries.

Chemical Cartridge Respirators

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"If It's for Safety, We Have It"

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PULMOSAN SAFETY EQUIPMENT CORP.,
176 Johnson St., Brooklyn, N. Y.
Gentlemen:—Kindly send detailed information on safety equipment designed for refinery protection.
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Address .....
.....
.....
(R)

Items About Manufacturers

L. O. Mitchell, Ward Chemical Company's sales representative, is on a tour of the Mid-Continent field in the interest of company business with refining and natural gasoline plants.

Westinghouse Electric and Manufacturing Company has issued two new publications pertaining to mechanical power transmission equipment for general industrial use.

"Westinghouse-Nuttall flexible couplings," is the subject of Circular 1887 which contains complete descriptions, capacities, dimensions and weights of the different types. Illustrations include typical applications of each type.

Circular 1891 entitled, "Westinghouse-Nuttall Speed Reducers Types SVR, DVR and DVRA," contains full information about the application, construction, ratings and dimensions of these vertical type units for single and double reductions and right-angle drives. Numerous existing applications of the different types are illustrated.

Copies of these publications are available upon request from any Westinghouse sales office or from the company's advertising department at East Pittsburgh, Pennsylvania.

Black, Sivalls & Bryson, Inc., Bartlesville, Oklahoma, announces the establishment of a refinery and gasoline plant division.

This new division offers a complete service to the refiner and natural gasoline manufacturer in designing, manufacturing and constructing his essential equipment. The work is supervised from the original plans to the entire plant, complete, ready to operate.

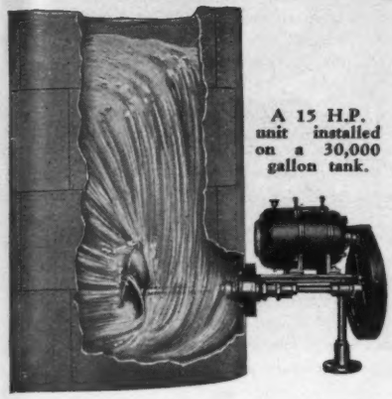
The office of this division is located at 430 South Rockford Street, Tulsa. The actual manufacture of the pressure vessel welded tanks and other equipment is produced in the factory of American Tank & Equipment Corporation of Oklahoma City, a manufacturing subsidiary of Black, Sivalls & Bryson. A staff of 17 engineers are employed to render service in the refinery and gasoline division. Their work is supplemented by the services of the engineers employed by Black, Sivalls & Bryson, and American Tank & Equipment Corporation.

The equipment being designed and manufactured includes for refiners: storage tanks, agitators, acid towers, condenser boxes, heat exchangers, aeriators, stills, smokestacks, breeching, etc., and for natural gasoline plants: fractionating units, bubble towers, scrubbers, non-absorbers, absorption towers, debutanizers, storage tanks, stabilizer towers, aeriators and heat exchangers.

Wilson-Snyder Manufacturing Company, Pittsburgh, has promoted George Hayes to the position of general sales manager of the refinery pump division, with headquarters at the home office. Mr. Hayes has been sales manager for the southwestern division of the company.

York Ice Machinery Corporation, York, Pennsylvania, has engaged W. R. McGinnis to take chage of the western division of the refrigeration department of the company's business. Mr. McGinnis will specialize in aiding oil refining companies in the application of refrigeration to the process of refining petroleum.

LIGHTNIN



A 15 H.P. unit installed on a 30,000 gallon tank.

The Quality of Your Product Depends on Your Mixing Methods

THE quality of your product can be traced directly to your mixing operations! And although the patented features found exclusively on LIGHTNIN agitators speed up production, lower mixing costs, and introduce modern mixing methods without the necessity of new tank equipment . . . the definite improvement they make in the quality of any product is their chief claim to superiority.

All Sizes and Speeds—Direct Drive and Geared Types

Photo at right shows portable direct drive Model "M" attached to large tank. Our engineers will cooperate with you in determining the correct power, speed and size for your needs.

Explosion-Proof Motors

Photo at right shows Portable Model "D" attached to an open tank. Explosion-proof motors furnished upon request.

MIXING EQUIPMENT CO., INC.

Originators, and Largest Manufacturers of Portable Electric Mixers

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Branch Office and Sales Rooms
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Fig. 2688 Edward Globe Valve, Swivel Plug Type, Stainless Steel Trim, Screw Ends.

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FORGED STEEL VALVES

Trimmed with

EValloy (Stainless Steel)

or

EValnite (Nitralloy as processed by Edward)

For

600 lbs. Working Pressure at 1100° F. Temperature

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EXPLOSION-PROOF MIXERS

Hy-Speed Portable Electric Mixers are the most efficient machines manufactured for blending, compounding, mixing or agitating all oils and liquid chemicals.

They clamp to any tank or vat in one minute and produce a more thorough, rapid mix . . . . more economically than by any other process. Capacities from five to 50,000 gallons.

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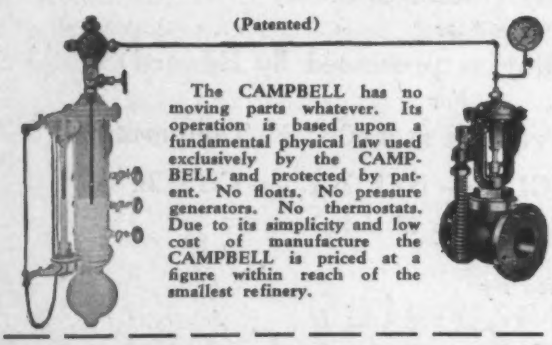
For mixing

LUBRICATING OILS
LIME AND OIL
FULLER'S EARTH & OIL
ALL LIQUID CHEMICALS

ALSOP ENGINEERING COMPANY
47 West 63rd St.
New York City

The CAMPBELL Boiler Feed Water Regulator

Repeat orders are positive proof of the dependability, simplicity, and accuracy of the CAMPBELL. No expert or costly service is required either to install or to maintain the CAMPBELL Regulator. The following are typical examples:



(Patented)

The CAMPBELL has no moving parts whatever. Its operation is based upon a fundamental physical law used exclusively by the CAMPBELL and protected by patent. No floats. No pressure generators. No thermostats. Due to its simplicity and low cost of manufacture the CAMPBELL is priced at a figure within reach of the smallest refinery.

Oil Refinery, Argentine
1928—12 CAMPBELLS
1929— 7 CAMPBELLS
1930— 3 CAMPBELLS

Oil Refinery, Sumatra
1928— 7 CAMPBELLS
1930— 8 CAMPBELLS

Industrial Plant, England
1929— 3 CAMPBELLS
1930—11 CAMPBELLS

ATLAS VALVE CO., 275 South St., Newark, N. J.

Without obligating me in any way please send complete information on the Atlas Products checked below:

☐ Campbell Boiler Feed Regulators
☐ Atlas Pump Governors
☐ Atlas Reducing Valves
☐ Victor Temperature Regulators
☐ Victor Damper Regulators
☐ Atlas Float Valves
☐ Atlas Swing Joint Fittings
☐ Atlas Bronze Unions
☐ Standard Thermostats
☐ Atlas Balanced Valves

Name..... Firm.....

Street..... City and State.....

Items About Manufacturers

Boiler Engineering Company of Newark, New Jersey, announces its affiliation with the Plibrico Jointless Firebrick Company of Chicago, manufacturers of Plibrico furnace lining. Boiler Engineering Company manufactures and installs the Beco-Turner baffle as well as the Turner baffle. Both baffles will now be marketed through the Plibrico representatives located in over 100 cities in the United States and Canada.

Refractory material used in the construction of these baffles will now be formulated from the same clays used in the manufacture of Plibrico furnace lining at the Plibrico plants located at Chicago, Trenton, New Jersey, and Firebrick, Ohio.

Boiler Engineering Company will continue to maintain headquarters at Newark. Main offices of the Plibrico Jointless Firebrick Company will remain at Chicago.

Brown Instrument Company, Philadelphia, has recently issued a new catalog featuring Brown indicating, recording and automatic control pyrometers. This catalog contains 104 pages with 141 illustrations, many of which are in two or more colors. A comprehensive resume of the theory and practice of applied pyrometry is presented, together with descriptions and illustrations of all instruments, thermocouples, protecting tubes and other required equipment.

This company has also issued a 32-page booklet titled "The Era of Automatic Control," This booklet carries, with illustrations, a brief outline of control instruments and methods in the various instruments ,and a page in picture is devoted to such subjects as controlling temperatures in steel treating, in oil refining, in steel mills, in blast furnaces, in chemical plants, and in die casting. Controlling flow, liquid level and pressure is discussed as are types of controls, and various other phases of controls as found from research by this company.

Roessler & Hasslacher Chemical Company, Niagara Falls, New York, has made Dr. W. F. Zimmerli head of its commercial development department, with headquarters at Niagara Falls. New appointments to the technical staff at Niagara Falls include:

Noah S. Davis, Jr., Ph.D., Yale, 1930; Alton Gabriel, Ph.D., Cornell, 1930; H. E. Klein, Ch.E., Perdue, 1930; Lloyd Mann, B.S., Middlebury College, 1930; H. A. McPhail, M.S., Toronto University, 1930; W. T. Rinehart, M.A., Indiana University, 1930; W. B. Tanner, Ph.D., State University of Iowa, 1930; Jane Williams, B.A., Indiana University, 1930.

Dr. J. H. Payne, of the Niagara Falls plant, has been assigned a year's leave of absence to complete his studies in Germany.

Socony Specialties, Inc., a subsidiary of the Standard Oil Company of New York, has begun the erection of a modern paint plant at the corner of Madison Avenue and K.C.S. tracks, Beaumont, Texas, adjacent to Magnolia Petroleum Company. The plant, the main building of which is approximately 75 by 75 feet and three stories high, is expected to be in production about January 1, 1931. A complete line of industrial paints, varnishes and enamels will be manufactured.

Socony Specialties, Inc., is a development of what has heretofore been Standard Oil Company of New York paint department, which was established about 1865, at Cleveland, but subsequently moved to Long Island City, New York, where since 1875 a large plant has been in operation.